Publisher's Page

Five More Candles

BECAUSE YOU, as one of the more than 20,000 paid subscribers of WORLD OIL have evidenced your personal interest, we feel you might want to take this moment to help light the fifth candle on the birthday cake of the monthly WORLD OIL and the 36th anniversary of the publication originally established as *The Oil Weekly*.

Oil men are busy men, and WORLD OIL editors know that we merit your reading only to the extent to which the publication, as a working tool of the industry, rewards you with operations and management ideas and information on oil industry methods, developments and equipment that will be helpful in getting your job done.

As a matter of information you might like to know something of the basic plan your editors follow in the selection and preparation of articles for WORLD OIL. Here are the four basic questions to which each article must have an affirmative answer before it is presented to you:

1. Will it help to improve the operations of an oil company, individual operator or contractor?
2. Will it help a company, individual operator or contractor to arrive at a decision or formulate a policy?
3. Will it help a substantial group of subscribers improve their personal position and chances of promotion?
4. Will it carry enough general interest to cause a large number of subscribers (at least half) to want to read it purely from an interest standpoint?

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BRIEFLY, THAT is the editorial precept of WORLD OIL. It is one reason why you will regularly find in each monthly issue the oil producing industry's largest array of engineering and operating editorial material. So, as we add another anniversary candle, we are happy that as a result of "eating the editorial cake", more men exclusively engaged in the oil producing business are subscribing to WORLD OIL now than has ever before been true of any oil publication.

The publishers deeply appreciate your continued interest and pledge themselves to the objective of making each consecutive issue of greatest value to you in your work.

Ray L. Dudley

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Truth of the saying "Nothing succeeds like success" is outstandingly proved by the BAKER RETAINER BRIDGE PLUG! The "well proved" design—based upon the long famous Baker Cement Retainer—has performed successfully in countless thousands of wells—for every purpose—at all temperatures—and at all depths.

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BAKER RETAINER BRIDGE PLUG

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The Changing Panorama

Oil Holds Prominent Place Among Giants of American Business

THE PETROLEUM industry occupies an especially prominent position in American business from the standpoints of both gross revenue from business transacted and capital assets employed. Sales are comparatively heavy because of vast public demand for its products. Assets employed are huge, for the industry must engage in extensive, costly operations, including production of raw material, manufacturing, and transportation.

With gross investment approaching $40 billion, the petroleum industry ranks fourth in the U. S. in gross assets, being exceeded only by agriculture, the railroads, and the public utilities. Vast properties and facilities are required to supply all the petroleum products wanted by the public.

As might be expected, oil companies are prominent among the nation's businesses. Among the top 100 manufacturing companies are 20 oil companies, and of the $60 billion of net assets represented by those 100 concerns, nearly $20 billion is accounted for by the 20 oil firms.

Among the industrial companies (not including banks, insurance companies, etc.), the largest company, on the basis of assets, is an oil company, Standard Oil Company (New Jersey), with assets of more than $4.7 billion. Five other oil companies have assets exceeding $1 billion each, including Standard Oil Company (Indiana), Socony-Vacuum Oil Company, The Texas Company, Gulf Oil Corporation and Standard Oil Company of California, in that order.

Considering all lines of business, including insurance companies, banks, utilities and railroads, there are several companies that outrank any oil company in total assets. These include Metropolitan Life Insurance Company, assets $10.9 billion; the Bell Telephone System, assets $9.7 billion; Prudential Life Insurance Company, $9.5 billion assets, and Bank of America, assets $7.5 billion. All these outrank in assets the Standard Oil Company (New Jersey), assets $4.7 billion. General Motors Corporation has assets of over $3.6 billion and U. S. Steel over $3.1 billion. Pennsylvania Railroad Company has assets over $2.4 billion.

Other companies with assets over $1 billion include Standard Oil Company (Indiana), $1.8 billion; Socony-Vacuum Oil Company, $1.8 billion; the DuPont Company, $1.6 billion; The Texas Company, $1.5 billion; Bethlehem Steel Company, $1.5 billion; Gulf Oil Corporation, $1.5 billion; General Electric Company, $1.5 billion; Standard Oil Company of California $1.4 billion, Sears Roebuck & Company, $1.3 billion; Westinghouse Electric, $1 billion.

From the standpoint of gross revenue, some oil companies rank comparatively high, but General Motors Corporation outranks any oil company, having reported net sales of $7.5 billion in 1951. That company had the largest gross revenue, in fact, for any U. S. company in any line of business.

Second only to General Motors in gross revenue in 1951 was Standard Oil Company (New Jersey), which took in $3.9 billion. This was less than the company's assets of $4.7 billion, showing typical oil industry results of requiring heavy investment in relation to revenue.

Industry-Wide Bargaining vs. Price Hikes

INDUSTRY-WIDE bargaining, an important labor union objective in the oil industry, would tend to make necessary a much heavier investment in storage and operating facilities, in precaution against strikes, and thereby would increase the cost of oils to the consumers.

This is the logical conclusion to be drawn from the experience of the steel industry, where industry-wide strikes have caused large loss of production and the necessity of more steel making capacity than would otherwise be needed.

Since the end of World War II the American steel industry has been engaged in a vast program of expansion which has added an average of about 2½ million tons each year to its ingot capacity, stated Benjamin F. Fairless, chairman and president of U. S. Steel Corporation. "Yet during this same period it has lost about 7 million tons of ingot production each year as a result of strikes. That means that for every ton of capacity we have added, we have lost nearly three tons of production.

"At Morrisville, Pa., U. S. Steel is now building the largest integrated steel plant that has ever been constructed in so short a time," Fairless continued, "yet it will take this plant ten years to turn out as much tonnage as our nation lost in less than eight weeks, this summer."

Price Lids Retarding Gas Conservation

AS LONG AS they remain in effect, ceilings on well-head prices of natural gas can be expected to have a retarding influence on natural gas conservation and the natural gas industry. Prior to inauguration of present ceilings, prices paid to producers were steadily improving, stimulating construction of gas processing plants and pipe lines and thus promoting conservation. Now producers are discouraged by frozen prices as well as the still existing threat that the Federal Power Commission may assert authority over producers' sales, earnings, and operations.

Two major companies have sought unsuccessfully to get the Office of Price Stabilization to authorize an increase of the price of gas in the Woodlawn field, Harrison County, Texas, from 10 to 11½ cents a thousand cubic feet, the highest bid made for their gas during the base period prescribed by OPS, December 19, 1950, to January 25, 1951. The hard freeze of gas prices may not cause hardship for the companies in this case.

But ceilings are in effect also for many other companies and independent operators, who may be seriously handicapped and discouraged by arbitrary holding down of prices below the levels that potential buyers are willing to pay.

Report from the Observatory

Adequate Winter Supply Now Assured

By **RAY L. DUDLEY**, Publisher, and **WARREN L. BAKER**, Editor

NO SHORTAGE of oil seems likely to exist this winter. Ill effects of the refinery strike last spring are being overcome. Record refining operations in August and September have gone a long way toward assuring adequate fuel oil supplies. October should provide additional heating oil supplies before consumption starts its seasonal upswing in November.

An excellent job by refiners of adjusting yields has helped the overall position of the industry along. Under the impetus of high refining output, refiners have made record quantities of distillate and gasoline while holding residual fuel yields to year-ago levels. This has improved the stock position of distillate and motor fuel while preventing accumulations of too excessive amounts of residual.

Crude oil is not in as good a position as refined stocks. Record production in September slowed stock withdrawal rates and these inventories are still on the high side. Peak producing volumes scheduled for October will further reduce drafts on crude stocks.

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HEATING OIL STOCKS are on the road to their highest level in history. With 108⅔ million barrels of distillate in storage tanks by mid-September, it appears more than 120 million barrels will be on hand by November 1. This would compare with 109½ million barrels a year ago on that day.

Mid-September inventories of distillate were 9¼ million barrels greater than in 1951. This constitutes a remarkable recovery. Because of the refining strike, distillate stocks at the end of June were 7 million barrels below the corresponding period of the previous year. Since that time some 43½ million barrels of distillate fuel have been put into storage tanks. Hence, the industry can enter the winter consuming season with the largest supply of heating oils in history.

In view of prospects that refinery output will continue substantially above levels of last year, this gain in distillate stocks should be adequate to satisfy the materially larger consumption anticipated this winter. It will take unusually cold weather to cause a shortage of heating oils now.

Should any shortage develop it probably will be spotty and be due to transportation troubles. Fortunately, most of the increase in distillate inventories has taken place in the area east of California, where it will be needed. Of the mid-September 9¼ million barrel gain over year ago volumes in distillate stocks, more than 8 million barrels are located east of California, where it will be needed.

Other refined product stocks also are in fairly good condition. Motor fuel inventories in mid-September were still 6¾ million barrels under 1951 levels. However, gasoline supplies can be replenished during the off-consuming winter season. Residual fuel stocks are a little larger than a year ago, but continued reduction of yields by refiners can prevent them from becoming too excessive.

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RECORD-BREAKING CRUDE production may become of some concern. Reductions in crude stocks, which reached sizable scale in July and August, slowed appreciably during the first half of September as a result of enlarged production. This left these inventories still a little on the high side. Additional peak production due in October will further reduce the rate of drawing on crude storage. During July and August crude stocks were reduced 20 million barrels, or 10 million barrels per month. Early September trends were at a rate of only 4 million barrels monthly.

While the outlook for crude is not too disturbing at the moment, it could become serious in the event refinery runs are curtailed next month. A cut in refinery runs loomed as a possibility because of the rapid accumulation of refined product stocks. Storage facilities of some refiners were filled, and they will be unable to continue to operate their plants in October at the record pace of preceding months unless demand picks up. Runs to stills in both August and September exceeded 7 million barrels per day for the first time.

Should any severe slowing down of refinery operations occur, peak producing rates would have a detrimental influence on the crude oil picture in view of large volumes currently in storage.

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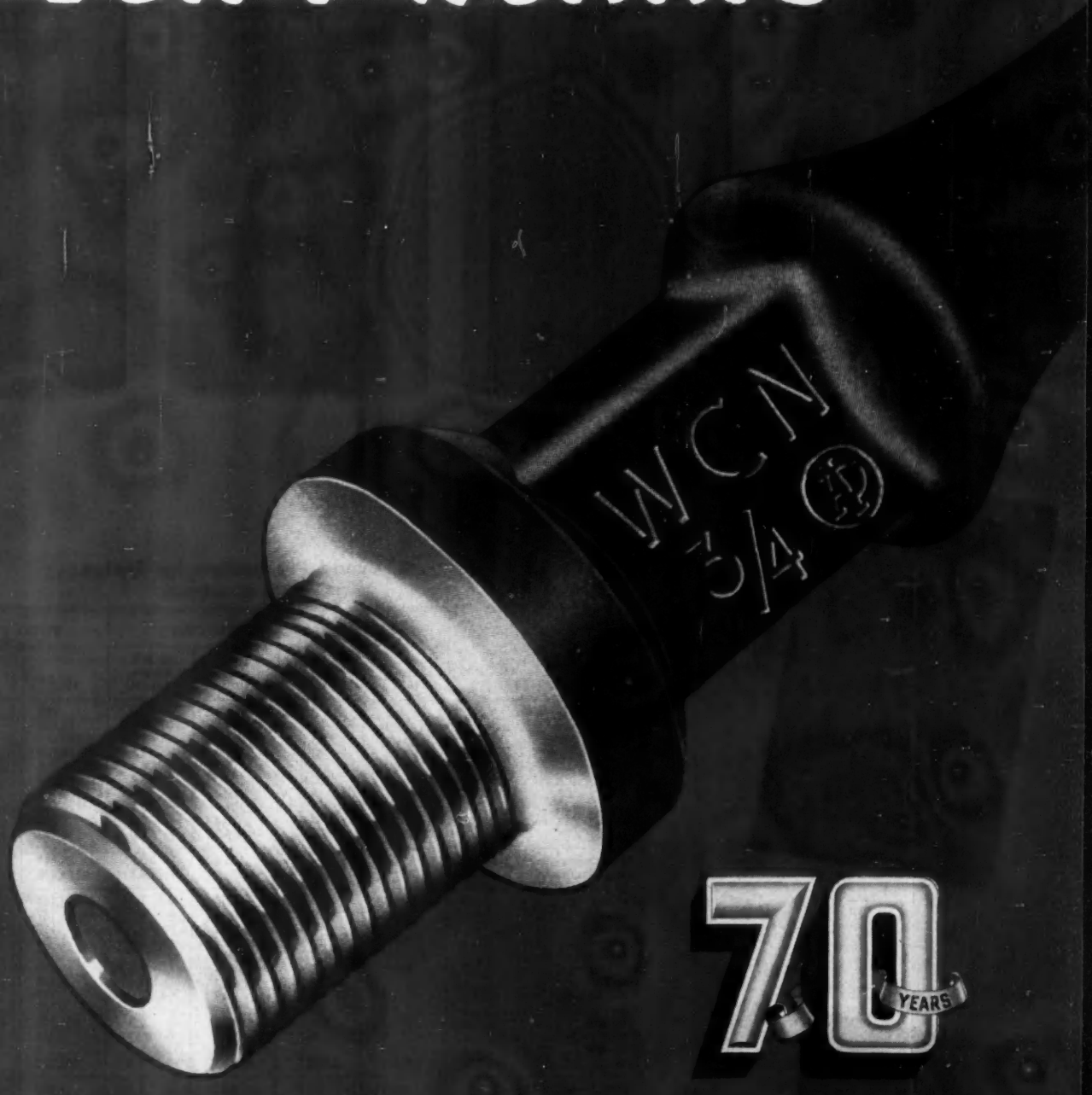
Those Who Know Sucker Rods

SPECIFY NORRIS



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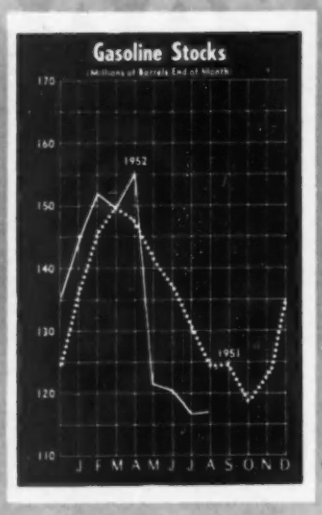
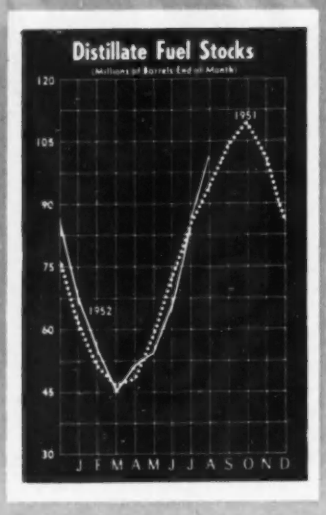
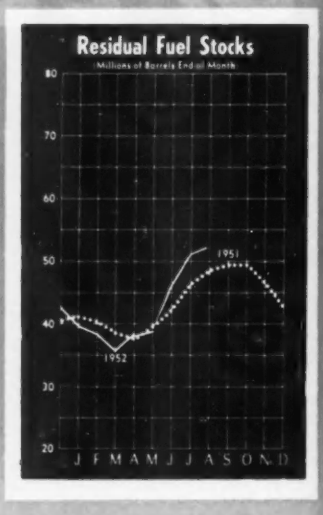
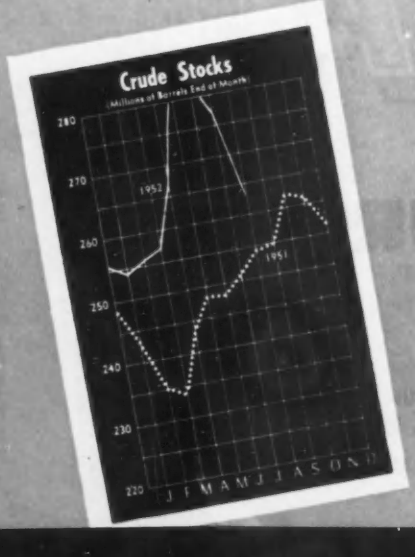








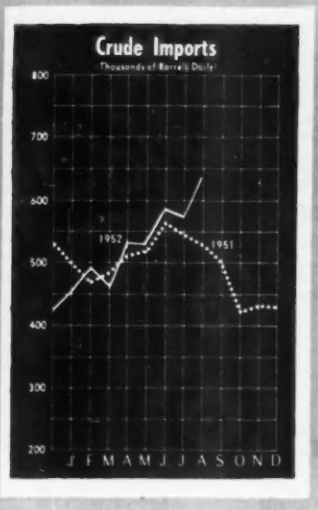
U. S. Crude Production by States

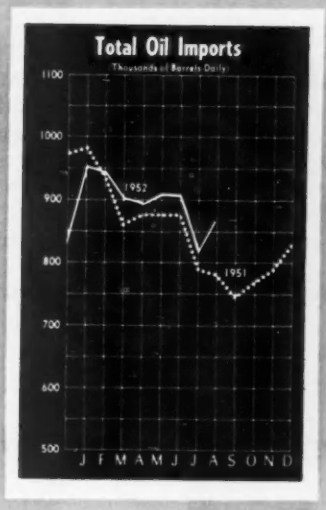
(THOUSANDS OF BARRELS)

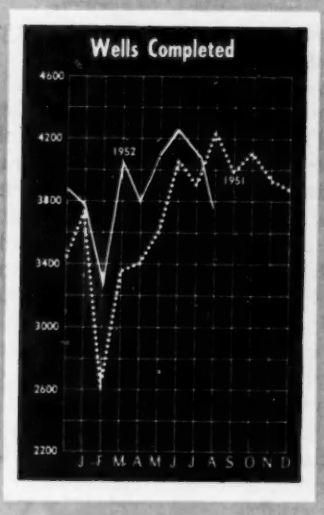
STATE or DISTRICT	DAILY AVERAGE PRODUCTION August, 1952	July, 1952	August, 1951	% Diff. August, '51-'52	TOTAL PRODUCTION First Eight Months 1952	1951	% Diff. '51-'52
Alabama	2.9	2.7	2.7	+ 7.4	632	689	— 8.3
Arkansas	77.0	80.6	80.4	— 4.2	19,582	19,084	+ 1.1
California	984.8	985.5	975.1	+ 1.0	239,461	234,878	+ 2.0
Colorado	83.8	83.5	75.0	+ 11.7	19,209	17,890	+ 7.4
Florida	1.7	1.7	1.6	+ 6.3	415	393	+ 5.6
Illinois	167.7	167.0	159.0	+ 5.5	38,998	39,151	— 0.4
Indiana	33.4	32.5	32.2	+ 3.7	7,792	6,756	+ 15.3
Kansas	323.0	324.3	322.4	+ 0.2	73,964	75,875	— 2.5
Kentucky	32.7	33.6	33.4	— 2.1	8,363	7,284	+ 14.8
Louisiana	668.2	673.4	636.2	+ 5.0	158,421	153,714	+ 3.1
North Louisiana	116.0	124.1	115.6	+ 0.3	28,941	28,887	+ 0.2
South Louisiana	552.2	549.3	520.6	+ 6.1	129,480	124,827	+ 3.7
Michigan	38.6	37.4	37.9	+ 1.8	9,114	9,453	— 3.6
Mississippi	96.2	96.5	100.4	— 4.2	24,137	24,763	— 2.5
Missouri	0.1	0.1	0.1	.....	16	20	— 20.0
Montana	26.9	26.6	24.9	+ 8.0	5,956	5,960	— 0.1
Nebraska	7.0	7.1	6.0	+ 16.7	1,397	1,731	— 19.3
New Mexico	158.3	163.4	144.7	+ 9.4	37,636	34,536	+ 9.0
New York	.....	13.3	12.1	— 100.0	2,553	2,840	— 10.1
North Dakota	5.3	3.2	0.2	+2550.0	467	9	+5088.9
Ohio	8.7	8.7	8.9	— 2.3	2,107	2,125	— 0.9
Oklahoma	530.2	519.5	518.0	+ 2.4	125,976	123,652	+ 1.9
Pennsylvania	41.3	29.1	31.1	+ 32.8	7,834	7,639	+ 2.6
Tennessee	0.1	.....	0.1	.....	6	10	— 40.0
Texas	2,785.8	2,605.7	2,829.4	— 1.6	665,222	661,793	+ 0.5
Dist. 1—South Central	33.3	31.9	33.7	— 1.2	8,002	8,049	— 0.6
Dist. 2—Middle Gulf	154.6	140.2	164.5	— 6.0	37,769	39,387	— 4.1
Dist. 3—Upper Gulf	468.9	436.2	495.7	— 5.4	112,874	119,292	— 5.5
Dist. 4—Lower Gulf-S.W.	249.2	229.3	261.4	— 4.7	61,583	61,652	— 0.1
Dist. 5—East Central	45.8	50.3	55.9	— 18.1	13,461	12,489	+ 7.8
Dist. 6—Northeast	384.7	380.3	390.2	— 1.4	94,911	94,255	+ 0.7
Dist. 7-B—North Central	97.9	91.0	82.0	+ 19.4	21,503	19,908	+ 8.0
Dist. 7-C—West Central	153.5	140.9	110.5	+ 38.9	33,432	24,016	+ 39.2
Dist. 8—West	937.8	862.0	971.3	— 3.5	223,548	223,679	— 0.1
Dist. 9—North	178.1	162.4	159.9	+ 11.4	39,038	37,451	+ 4.2
Dist. 10—Panhandle	82.1	81.2	86.0	— 4.5	19,956	21,542	— 7.4
Utah	4.7	4.2	4.0	+ 17.5	1,061	903	+ 17.5
Virginia	0.1	0.1	.....	.....	11	8	+ 37.5
West Virginia	6.8	6.9	7.9	— 13.9	1,719	1,842	— 6.7
Wyoming	188.7	182.1	188.6	+ 0.1	43,684	45,586	— 4.2
Total United States	6,274.0	6,088.7	6,232.3	+ 0.7	1,495,733	1,479,304	+ 1.1

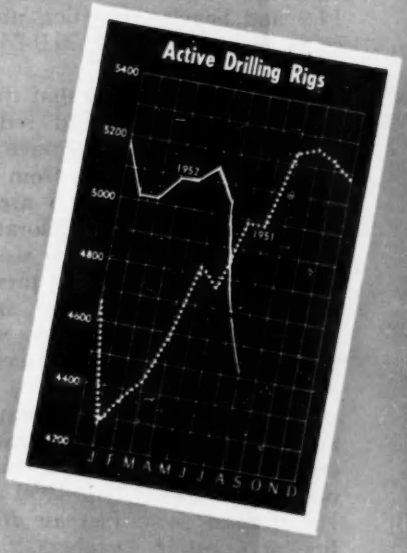
Trends in U. S.

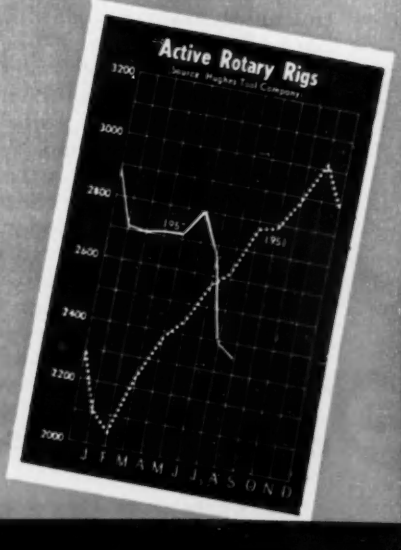
WORLD OIL Staff











Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1950:											
June	5,378	5,655	242,287	2,748	114,074	1,037	53,679	1,069	40,124	498	838
July	5,484	5,882	240,270	2,835	111,055	1,040	62,555	1,140	42,165	486	806
August	5,665	6,067	237,393	2,932	107,067	1,089	68,426	1,148	40,979	501	839
September	5,888	6,059	242,311	2,849	105,748	1,180	78,270	1,178	41,966	525	859
October	5,900	6,077	246,424	2,875	105,764	1,217	85,643	1,250	45,004	510	896
November	5,891	6,085	250,016	2,859	109,005	1,218	86,113	1,240	45,048	466	891
December	5,719	6,143	248,463	2,879	116,769	1,343	71,948	1,306	40,750	530	974
1951:											
January	5,907	6,450	243,107	2,962	136,145	1,427	62,163	1,368	41,251	499	977
February	5,930	6,562	235,247	2,906	145,184	1,419	51,348	1,382	40,716	468	937
March	6,052	6,469	233,824	2,908	149,679	1,327	46,744	1,348	38,366	483	861
April	6,127	6,183	243,180	2,821	147,679	1,171	48,239	1,230	37,623	511	871
May	6,170	6,436	248,418	3,031	141,658	1,210	59,272	1,265	39,879	518	876
June	6,130	6,575	248,170	3,100	137,009	1,254	72,140	1,277	42,398	563	876
July	6,141	6,462	250,847	3,091	130,931	1,228	84,282	1,275	46,320	546	788
August	6,232	6,539	254,276	3,114	124,202	1,237	94,028	1,226	48,365	529	780
September	6,261	6,558	254,900	3,127	124,530	1,282	104,082	1,228	49,608	500	744
October	6,375	6,446	262,266	3,105	118,864	1,295	109,544	1,224	49,573	421	769
November	6,272	6,609	261,100	3,130	122,723	1,358	101,666	1,304	46,491	425	802
December	6,182	6,646	255,783	3,150	134,867	1,442	86,619	1,313	42,853	423	834
1952:											
January	6,217	6,640	254,007	3,094	144,339	1,456	66,969	1,338	39,523	488	951
February	6,367	6,673	255,900	3,109	151,912	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	1,400	48,750	1,274	37,971	510	947
April	6,429	6,435	270,679	2,995	151,890	1,312	51,634	1,253	38,561	539	922
May	5,107	4,905	290,813	2,295	123,656	982	51,648	979	38,821	545	951
June	6,197	6,825	285,964	3,169	120,166	1,455	65,911	1,228	45,688	581	911
July	6,089	6,952	276,937	3,305	116,798	1,449	84,889	1,252	51,339	578	819
August	6,274	7,086	266,454	3,326	117,181	1,473	102,871	1,267	52,436	647	876
Aug., 1952: Change:											
In Month	+185	+134	−10,483	+21	+383	+24	+17,982	+15	+1,097	+69	+57
In Year	+42	+547	+12,178	+212	−7,021	+236	+8,843	+41	+4,071	+118	+96
Week Ended:											
9-20-52	6,514	7,060	264,406	3,426	118,315	1,468	112,472	1,218	53,484	661	933
9-22-51	6,298	6,550	252,569	3,107	123,120	1,364	102,334	1,194	48,724	635	849

Monthly News Analysis

Would Higher Prices Mean End of West Coast Shortages?

Inadequate price ceilings, coupled with a growing California crude oil shortage, are jeopardizing the most important source of fuel for military and defense activities in the Pacific area. These are among the reasons cited by Standard Oil Company of California in applying for an increase in the prices it pays for crude oil.

In its formal request, filed the latter part of last month with Office of Price Stabilization, Standard asked for an increase of from 10 cents to 50 cents per barrel for crude oil; 1.2 cents a gallon for automotive and aviation gasoline prices; 1.4 cents a gallon for heating and diesel fuels and 10 cents per barrel for heavy residual fuel oils. Proposed increases for crude oil would range from 10 cents for 14.0-14.9 and heavier gravities, up to 50 cents for gravities of 35.0-35.9 and higher.

The company stated that the price relief, if granted, would reduce or eliminate the current shortage by (1) attracting more supplies from outside sources to the District 5 area; (2) would stimulate more exploration for new oil in the district; (3) would encourage development and production from marginal properties; and (4) would stimulate secondary recovery of oil that cannot be produced economically at present prices.

The company pointed out in its application that the last general increase in California crude oil prices occurred in December, 1950 and the last general price increase for gasoline occurred in October, 1950.

West Coast refiners, it was brought out in the request, have taken emergency measures to eliminate the petroleum shortage. Standard Oil Company, the report stated, has been making sizeable importations of crude oil and is restricting current civilian sales in an effort to obtain the stocks necessary for its gasoline and diesel fuel trade this summer and its heating oil and diesel fuel customers next winter. Citing these merely as stop-gap measures, the company pointed out that these temporary steps were initiated before it was known that Congress would extend the authority of the Office of Price Stabilization and that the extension of price controls had forced it to make the application for price relief.

The application pointed out that indicated petroleum shortage on the West Coast is strictly a regional problem and is not matched by similar shortages in adjacent areas. The shortage reflects a marked growth in petroleum demand upon the West Coast, the company said, compared to a rather small increase in District 5 producibility.

"The recommended price increases," the company said, "are intended to correct a regional problem that would have occurred regardless of the outbreak of the Korean war and the imposition of price controls. These increases reflect the new dependence of the West Coast upon supply from other areas. Therefore they will require no similar price adjustments in areas having ample supplies."

Import Volume Due to Remain Steady

Lower tariff rates on U. S. imports of crude petroleum and residual fuel oil which become effective October 11 are not expected to result in any noticeable increase in the import volume during the remainder of this year, but may exercise some influence on foreign shipments to the U. S. in 1953. Crude and residual through the first eight months of this year accounted for approximately 96 percent of the total petroleum imports.

The new tariff rates are prescribed in the revised trade agreement between the U. S. and Venezuela. Under the "favored nation" clause of U. S. tariff regulations, the lower duties apply to petroleum imports from all sources.

It is estimated that the new taxes on imported crude and fuel oils will average betwen 7 and 8 cents per barrel, a reduction of about 10 cents a barrel from taxes paid in 1951, which averaged between 17 and 18 cents.

Prior to the making of the new agreement by the President of the U. S. and the State Department, the import tax on crude and residual was 10½ cents per barrel on a quota equal to 5 percent of total domestic refinery runs of the preceding year and 21 cents a barrel on the remainder imported. The average tax for 1951 was between 17 and 18 cents a barrel on crude oil and fuel oil.

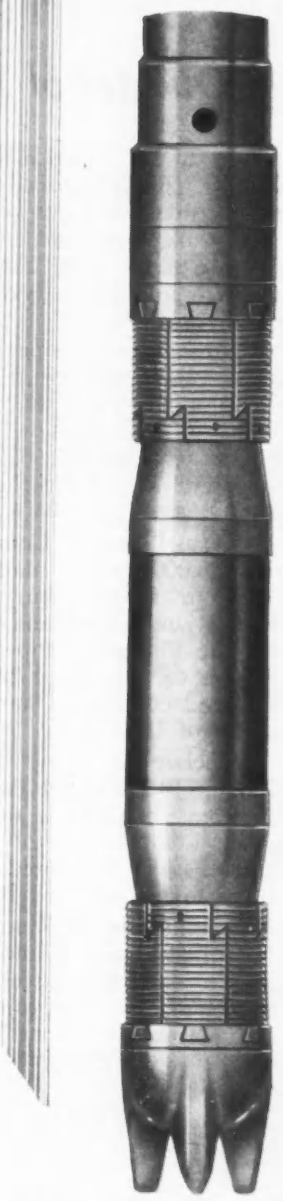
Under the new agreement, the 5 percent quota is eliminated. Imports of crude or fuel oils of less than 25 gravity will be subject to a tax reduced to 5¼ cents a barrel. Crude and fuel oil imports of 25 gravity and above will enter under a flat rate of 10½ cents a barrel. Based on 1951 imports it is estimated that these reduced rates will average between 7 and 8 cents, a reduction of about 10 cents a barrel from taxes paid in 1951.

When the new agreement was announced, it was labeled by the Independent Petroleum Association of America, perennial critic of imports, as "a price increase to the few importing companies." That association's general counsel, Russell B. Brown, declared that the new rates would benefit chiefly Standard Oil Company (New Jersey) and the Royal Dutch Shell combine, "which control practically all of the fuel oil imports into the U. S."

Brown charged that these import tax reductions constitute, in effect, price increases to importing companies, which will amount to millions of dollars yearly. "On the basis of 1951 imports," he said, "these reductions will total $30 million yearly. An increase in imports would mean even greater loss in Federal revenue, which would be added to the tax burden of the American public.

"The price increase to the importing companies discriminates against the domestic producer, whose crude oil price has been frozen at the 1947 level," Brown said. "This favorable treatment accorded the importing companies contrasts sharply to the

Which do you vote for?



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lack of consideration given the domestic oil industry. The Office of Price Stabilization has refused to recognize the inequitable and unsound price position of the domestic producing industry.

"In reducing the import taxes in the new Venezuelan Agreement, the President repudiated the findings of the U. S. Tariff Commission, as he had in other cases," said Brown. "That commission was charged by Congress with the responsibility of making a factual determination of the 'peril point' below which taxes could not be reduced without injury to the domestic industry. Half the commission fixed the peril point as the existing tariff schedule. The other three commissioners determined the peril point at a flat 10½ cents per barrel rate. The President ignored both of these findings and used State Department standards to justify the greater reductions made in the import taxes."

IPAA has contended that there is no need or justification for oil import tax concessions; that such concessions constitute an unsound policy of encouraging reliance on foreign oil. Importing companies and the Venezuelan government have argued that aside from filling a definite need of American consumers, the trade in oil stimulates U. S.-Venezuelan trade in general, to the benefit of the people of both countries.

The lower tariff rates will be of substantial benefit to Venezuela, which currently accounts for about three-fifths of the total crude oil and nearly all of the residual oil imported into the U. S.

Based on Venezuelan crude oil postings of Creole Petroleum Corporation and going contract tanker rates, the lowest priced Venezuelan crude could be landed on the U. S. East Coast at approximately $1.71 a barrel and the highest priced crude at $3.44 per barrel. Movement of Persian Gulf crude to the East Coast based on Persian Gulf posting for sales to other than producing firms and going tanker contract rates would be a maximum of $3.95 a barrel. The maximum from the eastern Mediterranean pipe line terminals to the East Coast would be $3.75 a barrel. U. S. Gulf Coast crude oil with a posted price of $2.56 a barrel under the same basic contract tanker rates to the U. S. East Coast would be delivered for just under $3 a barrel.

Steel Quota Set for First Quarter of 1953

For use of the petroleum industry in the first quarter of 1953, Defense Production Administration has allocated to Petroleum Administration for Defense a total of 1,556,744 tons of steel of all types. This will be equivalent to about 82 percent of the total allocated for third quarter 1952 use. The total will include 1,428,250 tons of carbon steel (including 165,000 tons of plate and 60,000 tons of structural steel), 127,894 tons of alloy steel and 600 tons of stainless steel.

In the case of tubular goods, the allotment to PAD for use in the first quarter of 1953 represents 100 percent of the third quarter 1952 allocation. This was allowed because no allocation of tubular goods was made for the fourth quarter, in view of the steel strike, so that there would be no final quarter priority tickets to be filled in 1953. Beginning with the initial quarter of 1953, therefore, the filling of tubular goods orders should be generally on current basis.

The outlook for pipe line construction now appears a little brighter, although several major construction projects probably will be delayed, as a result of the steel strike, from one to two quarters beyond the previously expected completion dates. These include the Shell Pipe Line Company's "Rancho" crude line from West Texas to Houston and the Pasotex Pipe Line Company crude line from Wink to El Paso, among others.

Dependent on delivery schedules of line pipe, PAD authorized a fourth quarter allocation of 510,050 tons of steel for crude oil, refined products, and gas transmission lines, not much below the allotments in each of the three preceding quarters. All of the previous allocations have not been delivered, however, due primarily to the strike and to some extent to a lag in deliveries prior to the strike. Crude and product lines were granted an allocation of 205,669 tons and gas lines 304,381 tons for fourth quarter operations.

Despite the delay in completion of pipe line projects that were commenced during late 1951 or earlier in 1952, PAD in its fourth quarter line pipe distribution gave allocations to the following major projects that had not previously received priorities assistance:

- West Coast Pipe Line Company's 960-mile, 200,000 barrels daily capacity crude line from Wink, Texas, to Norwalk, California (56,000 tons of a required 213,792 tons). Estimated completion date is the fourth quarter of 1953.
- United States Pipe Line Company's 1592-mile, 300,000 barrels daily products line from Port Neches, Texas, to Newark, New Jersey (20,000 tons of a required 319,500 tons). Estimated completion date is the fourth quarter of 1953.
- Texas Pipe Line Company's 196-mile, 96,000 barrels daily products line from Port Arthur, Texas, to Baton Rouge, Louisiana, connecting with the Plantation Pipe Line (28,451 tons or a required 28,451 tons). Estimated completion date is second quarter of 1953.
- Sinclair Pipe Line Company's 90-mile, 110,000 barrels daily products line from Philadelphia to New York harbor (14,894 tons of a required 14,894 tons). Estimated completion date is first quarter of 1953.

The latter two products lines originally had been scheduled to receive the total amount of steel needed for completion of the projects in the third quarter allocations, but delivery of the pipe was not made, due to the steel strike.

Syndicate Will Drill in Spain

An oil syndicate, headed by General American Oil Company of Texas, has put up $1 million for a drilling venture in Spain. Permission has been granted by the Spanish Government, which matched the ante, and the syndicate has been given a 170,000-acre lease about 75 miles east of Bilboa. Spain's interest will be handled by the Instituto Nacional de Industria, a government subsidiary. Surface geological work on the structure, which is six miles wide and 25 miles long, was completed by DeGolyer & MacNaughton, Dallas geologists, and geophysical exploration will be handled by Geophysical Services, Inc., of Dallas.

Assisting in the negotiations were John H. Murrell of DeGolyer & MacNaughton, Lewis MacNaughton and Gordon Simpson, General American attorney. Drilling is scheduled to start about the end of the year.

Jot it down

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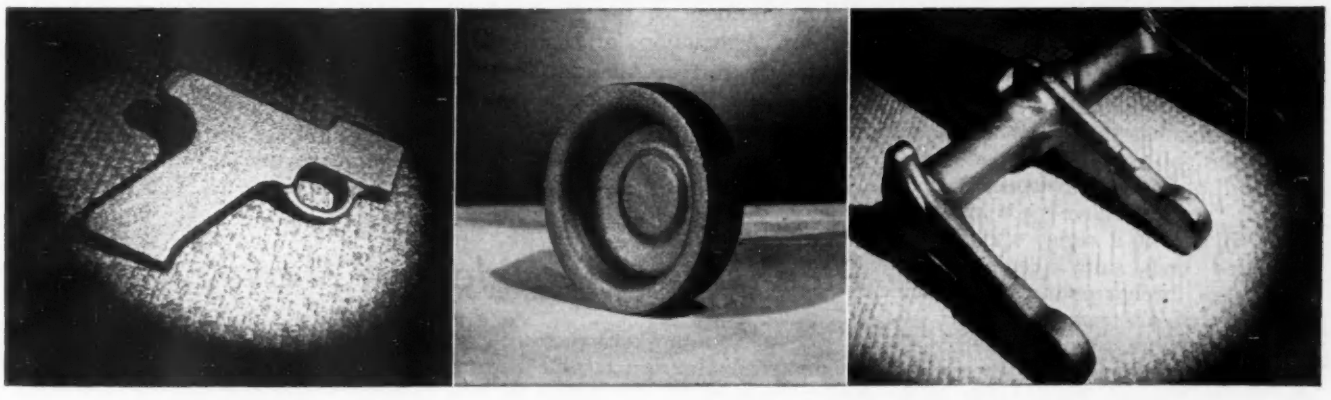

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Cartel Charges Called a Blot on U. S. Foreign Relations

The Truman administration, Department of Justice, and Federal Trade Commission have been charged by oil companies with doing serious damage to U. S. foreign relations in accusing oil firms of dominating the world's oil trade through an international cartel.

The oil companies have protested the issuance of the Federal Trade Commission report on the "cartel" and the serving of oil men with subpoenas to appear before a federal grand jury in Washington to produce documents concerning foreign oil operations.

Denying that it belonged to any international oil cartel, Standard Oil Company of California in early September issued an official statement answering cartel accusations and censuring accusers.

"Few American industrial ventures abroad have created such good will toward the U. S.," declared the company, "as have the Bahrein Island and Saudi Arabian developments," in which Standard of California has participated. "This has been a real post-war 'Point Four' program, without cost to the U. S. government, and America has benefited by the strategic availability of petroleum supplies for our country and for its military operations.

"Apparently as part of this general program against the larger U. S. oil companies operating abroad," the Standard of California statement continued, "we also have been made a party to one of a series of federally instigated civil suits alleging overcharges to foreign countries in their purchases of oil from companies affiliated with us. We are ready to prove beyond doubt that the prices we have charged have been fairly established on a competitive basis. It is obvious that the prices must have been competitive or it would not have been possible in a five year period to increase sales of Arabian oil from just under 60 million barrels in 1946 to nearly 278 million barrels in 1951.

"American companies in the international oil business have built American prestige to a high point in the countries in which they operate," the California Standard company claimed. "American companies have been trusted guests. There can be no immediate assessment of the damage these present unproved charges have done to this confidence and to our country's international prestige; but, our experience indicates this damage may well be difficult to repair. No matter how successfully we disprove the charges, they will cast their shadow over all American business operations abroad for some time to come. We shall do our best to repair the harm, but the responsibility for this disservice to our nation must rest with those within our own country who so recklessly made the charges."

Criticism of the cartel charges has come from the ranks of independent operators as well as major companies. At the Golden Anniversary meeting of the National Petroleum Association in Atlantic City September 10, Earle M. Craig, president of that organization and chairman of Freedom-Valvoline Oil Company, Freedom, Penn., declared that the cartel charges are not a matter of cheer for small businesses but rather a "cause for fear that a similar attack may be made upon us."

It is part of a shrewd propaganda technique, said Craig, that the attack on the large oil companies is made to appear as if carried out for the benefit of small business.

"These companies are charged with having gone out with their own money to find oil in previously unproductive areas of the world, of developing this production, and of winning and keeping for the U. S. a preeminent place in the petroleum world trade," commented Craig. "It is difficult to see how this accomplishment interfered with small business. Certainly no small company has the resources necessary to undertake the development of oil fields in the Middle East.

Shortages Blamed on Price Lids

Currently there are maladjustments in petroleum industry markets that cause shortages, surpluses and losses, as a result of the government's price control program, asserted Earle M. Craig, president of the National Petroleum Association, at that group's annual meeting at Atlantic City September 10. He said price controls "seriously imperil the industry's ability to serve the needs of our country."

The price controls, he continued, have caused "shortages of crude oil in Pennsylvania and on the West Coast. Shortages of products in some sections of our country are occurring, while markets in other sections are depressed by surpluses of these same products.

"Price freezing and arbitrary prevention of price adjustments, such as would occur if supply and demand were in effect, set at naught our philosophy of private enterprise and the incentive system," Craig declared.

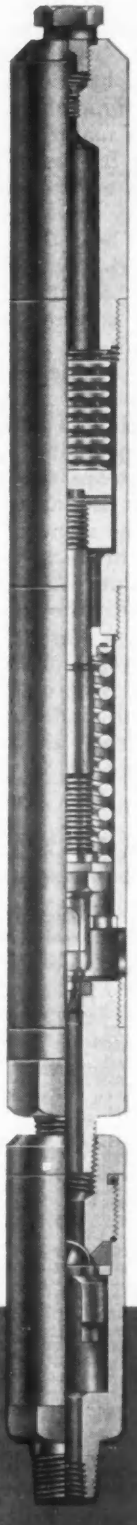
Pipe Lines to Provide New Market Area

Rocky Mountain and Western Canadian producing areas will be provided broader markets through projected new refining and pipe line facilities. Standard Oil Company (Indiana) has increased to 30,000 barrels daily the planned crude capacity of its proposed new refinery at Mandan, North Dakota. A products line will be built from that plant to the company's Fargo-Moorhead terminal of a products pipe from the Chicago refining area.

Amerada Petroleum Corporation tentatively plans a plant in the heart of the Williston Basin to recover natural gasoline and sulfur from the casinghead gas produced by oil wells. The residue gas is expected to go to a natural gas pipe line system.

Carter Oil Company will install a new polymerization unit at its 22,000 barrels per day refinery at Billings, Mont., permitting an 8 percent increase in recovery of high quality gasoline from crude run.

Shell Oil Company of Canada will begin construction this fall of additions to its Shellburn refinery at Vancouver, B. C. The plant's capacity will be doubled to a new volume of 15,000 barrels daily. Work is due to be finished about Oct. 1, 1953, when the first crude should reach Vancouver from Edmonton through the Trans Mountain pipe line, now under construction. That line will initially deliver about 75,000 barrels of crude daily, about half of which will be exported to California, the U. S. Northwest, and other points.



Patent Number 2,465,060. Other patents applied for.

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In this new Camco Type "CMC" Gas Lift Valve, an increase of gas pressure above normal operating pressure will draw the stem entirely out of the seat and free it of all foreign matter. When the pressure is reduced back to normal, the stem returns to normal operating position with a clean orifice.

The operation of the Camco "CMC" Valve is superior to the present Camco Type "MC" constant flow valve. In addition, it incorporates a special tungsten carbide tip and seat. The larger taper of the stem is the seating surface against the seat. The lower shank of the stem remains inside the seat in normal operation. The diameter of the shank is variable in restricting the gas flow to the equivalent orifice required. A greater flexibility is obtained in the control of gas necessary to efficiently aerate the flowing fluid column. By increasing or decreasing the annular pressure above or below normal operating pressure, an increase or decrease of gas is admitted into the tubing string.

The Camco Type "CMC" constant flow valve is available for use in retrievable valve installations.

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Pipe Shortage Reflected In Completions Decline

THE DIFFICULTY the petroleum industry is experiencing in getting pipe to drill wells became more apparent during August, when the number of completed tests dropped a little more than 10 percent from those recorded in July. Normally, completed wells reach their peak in August, but this year the pipe shortage caused by the recent steel mill strike reversed the trend. The full impact has not yet showed up in drilling statistics, and a further drop can be expected to appear in September's record.

New wells completed in August totaled 3721 to show a decline of 10.3 percent from the 4150 credited to July. Even July's wells had slipped about 2 percent from the year's peak of 4235 recorded in June. A year ago, August's wells had been about 5 percent more numerous than they had been the previous June, which shows how the trend has been changed this year.

At the end of eight months, total wells drilled this year totaled 31,368 to maintain a lead of 6.6 percent over the 29,432 completed in the same period of 1951. However, the margin is rapidly being whittled. A month ago, the difference had been almost 10 percent, and with full impact of the pipe shortage to be felt, the spread is yet to be narrowed.

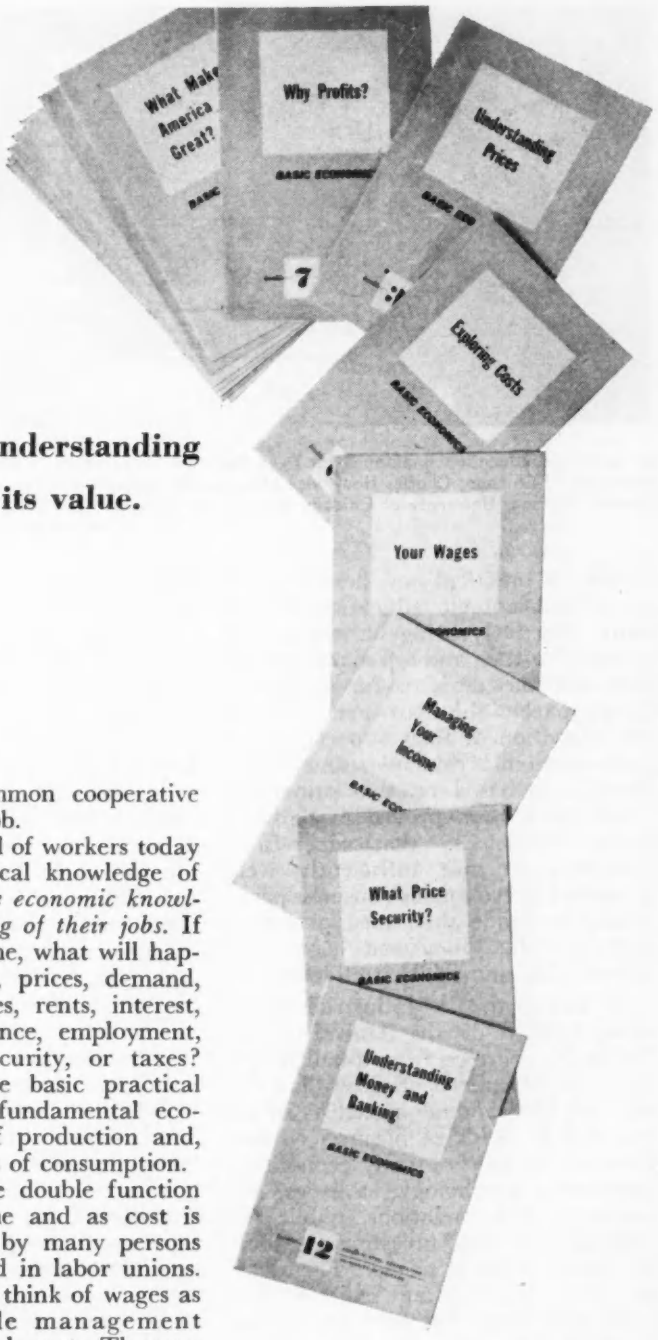
Drilling cutbacks have not yet become evident in some areas, while in a few others it is already apparent. Texas has borne most of the easing so far, with the northern and western districts bearing the brunt. West Texas' letup in drilling has not been caused entirely by the pipe shortage, although it has been a major factor. Part of the slackening has been due to the revised outlook on the Spraberry trend prospects by some operators. The Spraberry has been the most active area in the U. S. since 1951, but prospects of poor payout on expensive wells is now causing some revisions in drilling plans.

Active drilling rigs in the nation totaled 4508 at the end of August. That represented a decline of 186 rigs or 4 percent during the month, and 480 rigs or 9.6 percent less than the 4988 reported active at the same time a year ago. Texas is the scene of the greatest concentration of stacked rigs. One hundred of the state's rigs were put on the shelf during the month, and the total left at work was 408 less than were counted a year earlier. In West Texas alone, 50 rigs were stacked during the past month and the remaining totaled 408 fewer than had been working a year ago.

Wells Completed in the United States During August, 1952, and First Eight Months, 1952

State or District	MONTHLY COMPLETIONS, AUGUST, 1952 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: Aug., 1952	July, 1952	Aug., 1951	Footage August, 1952	CUMULATIVE TOTALS January-August: Wells 1952	Wells 1951	Percent Dif.	Footage 1952	Footage 1951	Rigs in Operation (Drilling Rigging Up and Shut Down): Aug. 31, 1952	July 31, 1952	Aug. 31, 1951
Alabama	2			3				5		5	10	3	29,863	43	38	+ 13.2	251,629	176,123	7	4	5
Arizona														1	2	— 50.0	3,544	3,830	5	3	2
Arkansas	18			20				38		38	37	47	138,225	268	272	— 1.5	982,315	931,586	43	41	35
California	169	1	4	45				219	6	225	188	187	937,861	1,728	1,588	+ 8.8	7,052,281	6,126,763	237	247	236
Colorado	14		1	34				49		49	41	25	248,908	285	154	+ 85.1	1,544,484	743,687	43	32	40
Florida											2	1		6	3	+100.0	39,081	14,614			
Georgia															1	—100.0		12,844	1	1	1
Idaho																					
Illinois	92		7	151				250		250	218	250	651,074	1,321	1,523	— 13.3	3,265,715	3,792,922	175	212	201
Indiana	46		1	81				128		128	147	156	225,766	861	793	+ 8.6	1,531,065	1,437,913	132	197	187
Kansas	108		23	125			1	257		257	445	390	899,355	2,883	2,717	+ 6.1	10,013,521	9,266,999	408	412	422
Kentucky	33		17	50				100		100	92	120	206,989	773	824	— 6.2	1,598,401	1,663,659	84	96	99
Louisiana	81	12	22	88				203	1	204	194	256	1,355,216	1,530	1,439	+ 6.3	10,225,629	9,132,275	205	217	229
North Louisiana	40	2	12	63				117	1	118	112	172	469,701	832	794	+ 4.8	3,129,054	3,048,193	60	66	77
South Louisiana	41	10	10	25				86		86	82	84	885,515	698	645	+ 8.2	7,096,575	6,084,082	145	151	152
Maryland			4					4		4	2	4	14,136	29	23	+ 26.1	113,209	91,124	13	16	28
Michigan	21		4	32				57	1	58	80	69	142,648	449	470	— 4.5	1,199,689	1,174,500	90	108	111
Mississippi	9		2	21				32		32	29	38	224,107	236	241	— 2.1	1,701,633	1,551,285	32	36	37
Missouri			1	1				2		2	5		1,746	26	3	+766.7	27,043	658	3	2	6
Montana	9		3	16				28		28	22	37	85,821	161	179	— 10.1	494,809	411,710	67	64	46
Nebraska	14		2	27				43		43	11	15	218,532	143	97	+ 47.4	715,279	451,570	14	18	18
Nevada															2	—100.0		15,431	1	1	1
New Mexico	40		13	18				71		71	91	57	469,287	741	450	+ 64.7	4,108,350	2,158,005	169	144	149
New York	79				49			128		128	106	53	176,684	695	359	+ 93.6	965,827	511,523	126	115	60
North Dakota	5							5		5	2	2	43,499	33	6	+440.0	303,317	32,799	28	22	6
Ohio	31		19	33				83	3	86	77	82	189,211	643	596	+ 7.9	1,383,268	1,190,013	171	169	149
Oklahoma	271	2	28	207	8		2	518	13	531	463	548	1,961,525	3,963	3,707	+ 6.9	14,678,279	13,304,299	540	550	610
Pennsylvania	66		18	7	61	8		160	1	161	145	150	270,364	1,134	996	+ 13.9	1,924,336	1,717,753	288	266	252
South Dakota											1			2			12,413		2	4	1
Tennessee															6	—100.0		7,465	5	5	9
Texas	629	13	59	506	1		1	1,209	23	1,232	1,678	1,698	5,936,561	12,538	12,035	+ 4.2	59,897,401	52,206,111	1,293	1,393	1,701
Dist. 1 S. Central	13		4	39				56		56	67	81	152,717	479	423	+ 13.2	1,404,672	1,201,677	33	33	29
Dist. 2 Middle Gulf	12	6	7	41				66	1	67	69	73	430,434	566	509	+ 11.2	3,564,142	2,972,878	46	51	66
Dist. 3 Upper Gulf	74	5	2	39				120	1	121	131	128	805,677	1,205	1,040	+ 15.9	7,955,155	6,423,450	114	127	136
Dist. 4 L. Gulf-S.W.	52	1	18	45				116		116	147	150	660,536	1,144	1,165	— 1.8	6,055,612	5,730,376	89	103	126
Dist. 5 E. Central	12		1	20				33		33	28	42	135,448	244	321	— 24.0	1,230,034	1,235,231	33	33	26
Dist. 6 Northeast	16		4	12				32		32	54	53	188,047	380	489	— 22.3	2,333,097	2,457,901	29	30	40
Dist. 7-B N. Cent	91		3	93			1	188	1	189	240	278	585,194	1,895	1,863	+ 1.7	6,016,637	5,348,287	129	137	194
Dist. 7-C W. Cent	108		1	36				145	2	147	188	165	874,362	1,518	964	+ 57.5	8,838,843	4,374,172	181	214	177
Dist. 8 West	122	1	1	47				171	18	189	374	395	1,106,303	2,491	2,720	— 8.4	14,049,385	14,748,938	288	305	307
Dist. 9 North	117		2	117	1			237		237	321	199	850,519	2,169	1,956	+ 10.9	7,022,333	5,866,175	267	269	274
Dist. 10 Panhandle	12		16	17				45		45	59	134	147,324	447	585	— 23.6	1,427,491	1,847,026	84	91	126
Utah	4		2	5				11		11	9	7	83,323	46	22	+109.1	294,545	101,352	34	30	27
Virginia																					1
Washington																					1
West Virginia	5		40	13				58	1	59	42	43	161,547	406	394	+ 3.0	1,207,149	1,144,578	210	210	205
Wyoming	38			25				63		63	63	71	289,274	424	492	— 13.8	2,134,923	2,417,930	81	79	113
Total U. S.	1,784	28	270	1,508	119	8	4	3,721	49	3,770	4,200	4,309	14,961,522	31,368	29,432	+ 6.6	127,669,135	111,792,308	4,508	4,694	4,988

Economic Education Of Supervisors



Training plan relays business understanding to workers. No cure-all but statistics prove its value.

By DR. MORRIS M. BLAIR
Professor of Economics, University of Tulsa

ALTHOUGH economic education of supervisors is no "cure-all of management problems, experience of the past five years shows that it is one practical and efficient device for improving effectiveness of supervisors in their contacts with top management and men who work by the hour—so-called "hour men." It can be tailor-made to fit the oil or any other industry. Its second value is that it is real economic education, objective and with open, free, and full discussion by all participants.

Supervisors are the key men in the contacts between management and employes. They are middlemen — liaison officers—who might be described as the spark plugs of power which fire the potential energy of the hour men. Just as a too widely spaced or otherwise deficient spark plug causes an engine to misfire, sputter and die, so do supervisors poorly trained or equipped for their broad and heavy responsibilities cause a business to lose efficiency and, in some instances, to fail entirely.

If the employes are to have a fuller knowledge of their tasks and better training, they must get it from the supervisors. If management is to bring a better knowledge of the jobs to the employes from scientific experts they must do it through the supervisors. Not only are supervisors vital points of contact between employes and management in getting the job done, but also in getting a better job done for all. They are educators, teachers of both labor and management of what each needs to know about the other in their common cooperative overall economic job.

The greatest need of workers today is not more technical knowledge of their jobs, but *more economic knowledge of the meaning of their jobs.* If a given thing is done, what will happen to production, prices, demand, supply, costs, wages, rents, interest, investments, insurance, employment, profits, savings, security, or taxes? We all need more basic practical education on the fundamental economic principles of production and, therefore, the limits of consumption.

For instance, the double function of wages as income and as cost is poorly understood by many persons in management and in labor unions. Union leaders may think of wages as only income, while management thinks of them as only costs. They are both, and both aspects must be considered or only loss and confusion will result.

The origin and functions of profits again illustrate the nearly universal need for economic education. Labor may sometimes think of profits as part of their earnings taken from them by management through sharp bargaining instead of guarantee of permanent employment. Bankrupt firms employ no labor. Companies with good profits and large surpluses are certain to continue operations and to expand operations with better equipment and, therefore, to have better jobs. Profits mean security of jobs and income to wage earners.

Inflation and rising taxes affect labor and employer alike, but frequently the best means of safeguarding both wages and profits from unnecessary losses are unknown. The hour-men have as much personal interest in these basic and universal problems as the company has. They can aid each other to escape greater loss if only they know how. These and other economic problems can be clarified for the hour-men only through the supervisors with whom they work.

The training of supervisors by some method or other for various purposes is an old activity of management, but the method presented here is new and somewhat revolutionary.

The recently organized Industrial Relations Center of the University of Chicago, through careful, extensive and applied research, has de-

An economic education is planned for Deep Rock Oil Corporation. In on the design committee conference are, left to right: Charles Gaisor of the University of Chicago; Charles Houy, vice president of production; Andy Springfield, assistant manager of employe relations and program coordinator; Howard Johnson, University of Chicago and project manager; Bill Carthaus, vice president of manufacturing and research, and Maurice Davies, manager of accounting.

veloped a practical and flexible program of economic education which more effectively bridges the gap between hour-men and top management than any other device so far advanced. It approaches the hour-men through the education of their supervisors in basic economic principles and problems. It is based on two principles which have been proved to be perfectly sound; (1) that supervisors generally are not sufficiently well grounded in economics (business principles) to guide their men properly, and (2) that they can learn this information and apply it effectively.

In five years the Industrial Relations Center of the University of Chicago has grown from a half dozen to a staff of experts of more than 60, who are outstanding specialists in all the related fields of business education and management, economics, marketing, psychology, statistics, accounting, labor relations, public relations, taxation, investments, sociology and political science. The array of talent, learning and experience is wide and deep, but its applications to economic education are direct, simple and most effective. It does not teach in the usual sense but merely helps willing men to learn. Its purpose is to develop supervisors as intelligent, informed leaders of men. It is a tailor-made education designed to fit the men it seeks to serve.

It has five objectives:

- **"Knowledge:** To increase knowledge about the operation of the economic system and the role of the company in it.
- **Thinking:** To provide a framework within which economic proposals and problems can be analyzed and appraised.
- **Values:** To develop an appreciation of the values, benefits, and rewards to the individual as a part of the company and of the economic system.
- **Confidence:** To increase confidence in the company and the economic system.
- **Applications:** To encourage desirable changes in attitudes and behavior on and off the job."[1]

The regular course lasts 15 weeks, with an hour and a half conference in each weekly meeting. The courses are taught by company men whom the supervisors know and respect. Classes are usually limited to 18 to 20 men, so that extensive individual and general discussion may be employed at all times.

The course is begun by presenting to the supervisors a series of questionnaires or examinations on the following topics: profits, prices, wages, fiscal policy and national income, monetary policy, government debt, productivity and progress, monopoly, equality of opportunity, the role of unions, security, pensions and personal economics, capital and depreciation.

At the end of the 15 weeks' course another set of questions measure how much attainment has been secured. Interest checks and personal interviews are also used.

The first large corporation to put this method of practical economic education to the test was Republic Steel in 1949. Since that time they have trained about 3300 supervisors in 26 plants in five states and are so well satisfied with the results that they are in process of training 2700 more supervisors in their subsidiaries. This educational program has been carried out by Republic's employes trained by the Industrial Relations Center to do the job for their own supervisors. The company, not the university, does the training of the supervisors. The university merely trains the teachers of the supervisors.

As a check on the effectiveness of this economic educational program, tests were given before and after the course to (1) college students, (2) top and middle management, (3) secondary school teachers, (4) foremen and union leaders in both economic knowledge and in economic opinions. The results are shown in Table 1.

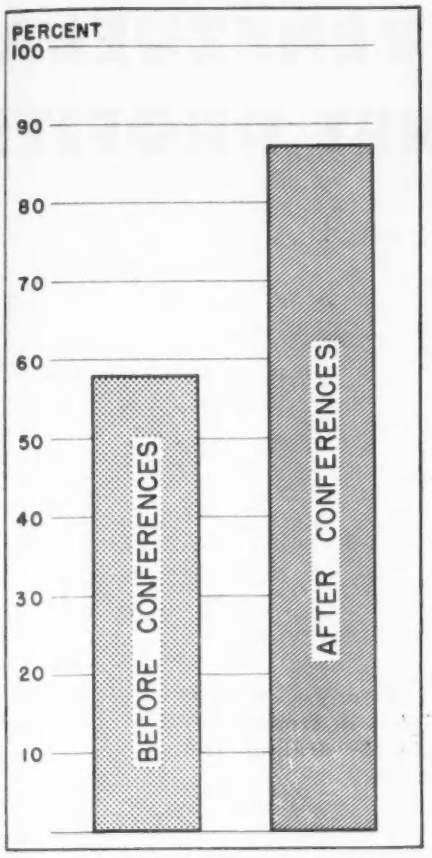
The effectiveness of these 15 weeks

TABLE 1
Economic Knowledge

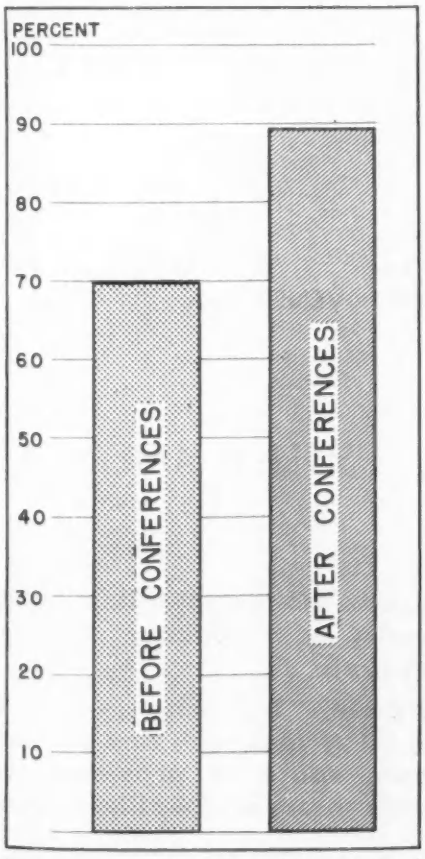
Before Training			After Training		
Rank		Grade Percent	Rank		Grade Percent
1	College Students	82.5	1	**Foremen**	87.0
2	Top and Middle Management	75.0	2	College Students	82.5
3	Secondary School Teachers	74.0	3	Union Leaders	77.0
4	**Foremen**	57.5	4	Top and Middle Management	75.0
5	Union Leaders	56.5	5	Secondary School Teachers	74.0

Economic Opinions

Before Training			After Training		
Rank		Grade Percent	Rank		Grade Percent
1	Top and Middle Management	77.0	1	**Foremen**	89.0
2	Seconday School Teachers	76.5	2	Top and Middle Management	77.0
3	College Students	71.0	3	Secondary School Teacners	76.0
4	**Foremen**	70.0	4	Union Leaders	75.0
5	Union Leaders	63.0	5	College Students	71.0



Percentage increase in economic knowledge of supervisors after tests at Republic Steel Corporation.



Increase in economic opinions of Republic Steel Corporation supervisors after tests. (Source: *Experiments in Economic Education* by Burns and Michelson.)

of intensive economic education of supervisors is indicated by the fact that in both economic knowledge and economic opinions, foremen or supervisors rose from fourth to first place rank of percentage attainment. The reasons for this result were, (1) the thoroughness of the work, and (2) the interest in the courses which was developed among the supervisors. Although some of the supervisors began courses with some prejudice and doubts, usually after the first three to five lessons, they entered into it with enthusiasm and rarely missed classes. Most of those who were compelled to miss any conference asked that it be repeated for them.

The questionnaire used to check the progress of the supervisors is divided into five parts, testing: (1) economic knowledge, (2) economic opinions, (3) ability to analyze problems in basic economic areas, (4) general attitudes toward management, and (5) specific knowledge of the company. The 15 weeks course raised the supervisors in economic knowledge from 57.5 percent to 87 percent and in economic opinions from 70.0 percent to 89.0 percent. These are the results obtained among 3300 foremen of Republic Steel.

Since the supervisors are the direct contact points with the hour-men, the benefits of their improvements are passed on to the hour-men in close daily contacts. As economic questions and problems arise among the hour-men the supervisors are able to answer them and pass on a better and more favorable understanding and attitude toward the company and of their relations to it.

At first it was feared that labor union leaders might be opposed to the program. But many of them took the course and reacted favorably to it. The reason for this is that the approach is objective, without bias and permits full discussion of all problems.

The Industrial Relations Center has spent five years in extensive research and practical testing of the methods and materials employed in these conferences. Their largest service to date has been Republic Steel, with 70,000 employes and 7000 supervisors. Courses are progressing with other large corporations, including Continental Can, American Maize Products, Standard Oil of Ohio and half a dozen others.

Arrangements have been made by which the University of Tulsa and the University of Chicago will jointly present these services in the Southwest. The University of Chicago recently completed the training of a group of personnel of the Deep Rock Oil Corporation of Tulsa to carry on a series of conferences among the supervisors of this company, which is the first to undertake this specific educational program in this area. Other companies are considering similar steps.

The University of Tulsa in its joint administration of this service with the University of Chicago will make possible a vast expansion of economic education for supervision and other employes in the Southwest. Dean M. M. Hargrove of the College of Business Administration of the University of Tulsa is director of this expanded service in this region, and is providing plans, personnel and equipment to supply this service to those who desire it by September, 1952.

[1] "Experiment In Economic Education," Robert K. Burns and Leno C. Michelon, Industrial Relations Center, University of Chicago, 1952.

About the Author

DR. M. M. BLAIR, head of the management department and professor of economics and statistics at The University of Tulsa, has had many years of experience in business and education and is the author of a number of books including "Elementary Statistics," used as a textbook in over 60 colleges throughout the country. He received his B.S. degree from Southwest Missouri State Teachers College; his M.A. degree from The University of Missouri and his doctor's degree from The University of Wisconsin with additional academic training at Drake University and Arkansas State Teachers College. His business experience has been with the B. F. Goodrich Company, Akron, Ohio, and the Mercantile Trust Company, Little Rock, Arkansas. He went to The University of Tulsa after 17 years at Oklahoma A. and M. College, Stillwater, Okla. He also taught at Southwest Missouri State Teachers College, Stephens College, The University of Missouri and New York College.

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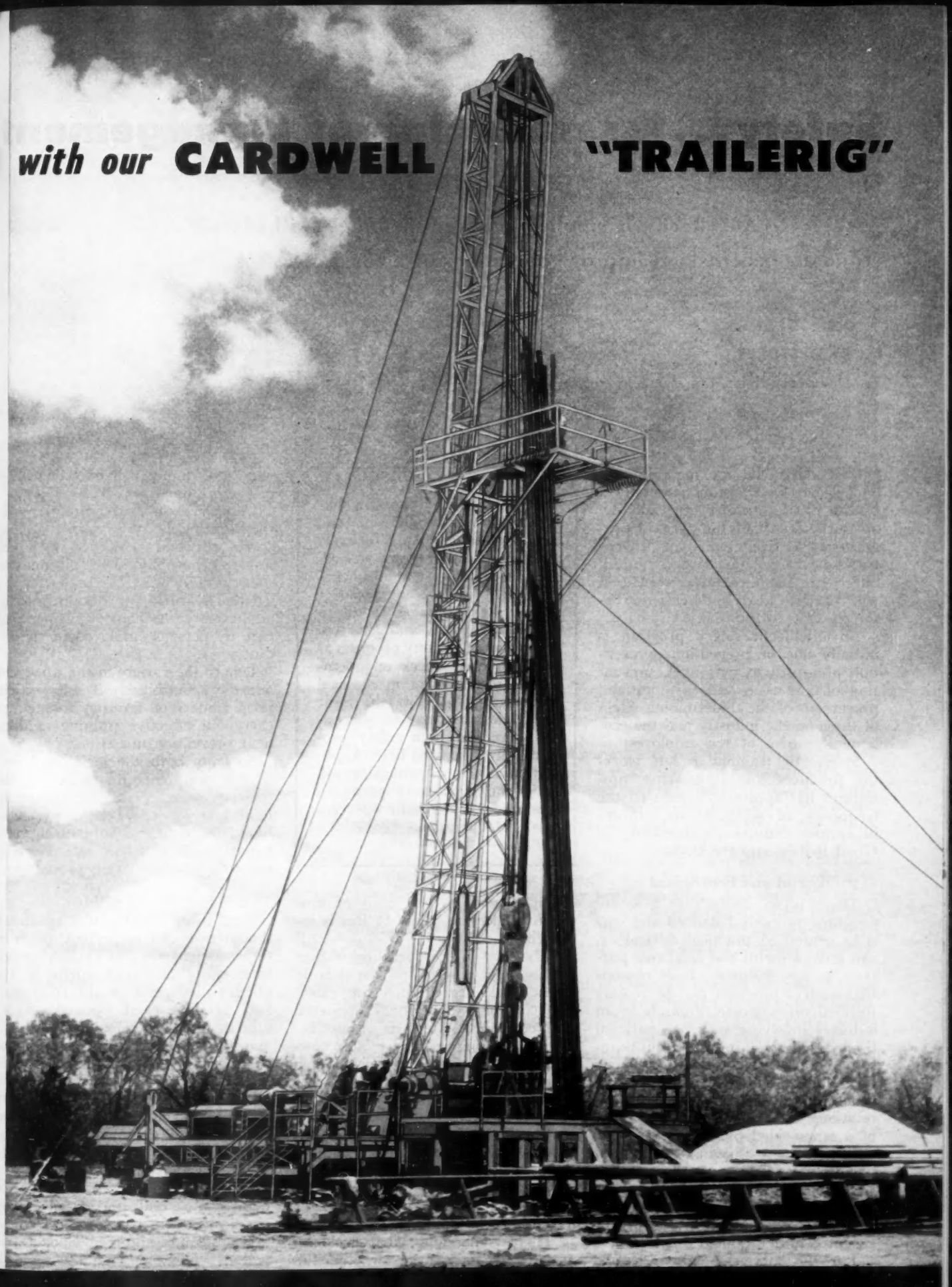

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Safety...Essential Job of Management

An effectively applied program definitely will provide economic benefits and improve operations of a company.

By B. L. STOREY
Trinidad Lease-Holds, Ltd., London

PLANNING for the safety of employes is fundamentally a management responsibility. an integral part of the over all program of effectively managing any enterprise where people are employed. Successfully applied safety education will make oil fields and refineries beter places to work.

An intelligent safety program is initially one of prevention—prevention of injury to personnel, prevention of lost time and earnings and prevention of the undermining effect of these on the industry and the economic security of the employes.

Systematic training in safe working practices and operating procedures has appreciably reduced the frequency of accidents in industry in various countries, particularly in Great Britain and the U. S.

MANAGEMENT has an important responsibility in the realm of safety. An effectively applied safety program will result in definite economic benefits, improving the operations of a company. It is as sound to record the results obtained from operation of a safety program as to keep close check on operational results from mechanical equipment. Some of the basic principles that may be successfully applied in a safety program are discussed here. Application of these principles will gain the support of personnel and promote efficient and economical operation.

Useful and Economical

There is no doubt that a safety program, properly balanced and sensibly geared to practical difficulties, can serve a useful and economic purpose in any industry. It is obvious that such a program can be readily justified on economic grounds in an industry involving such occupational hazards as the oil industry. But purely economic consideration of a course of action on a matter which falls so clearly in the category of industrial relations, is taking a one-sided view of a many-sided picture.

In the successful management of people there is a compelling necessity to maintain consistently a strong moral position. In the past, industry in general has not always given sufficient consideration to this aspect.

For the successful administration of a safety program, it is a necessity to make decisions on the basis of whether something is right or wrong —not merely on the basis of how much immediate profit or loss is involved.

Efficiency in the operation of producing and refining oil depends in considerable degree on having effective control over personnel, material and equipment. Records of production, processing and the related costs are basic essentials in insuring such control.

Much is devoted to recording the manner in which material is used and to the operational results obtained from mechanical equipment. It is fundamental to record the results being obtained from that equally important part of the investment—the people employed.

There is no doubt that accidents are directly indicative of whether this part of the investment is giving the returns it should. Unsafe practices are generally unsound practices which inevitably will be reflected in production inefficiency.

Consideration of the effects which the introduction of modern tools and equipment and advanced technical processes have had in the oil industry suggests a definite need for the development of a greater degree of adaptability, mechanical instinct, and care by persons employed in the industry.

Due to the variety in the work and added responsibilities, it is impossible for a modern oil industry foreman to carry out effective training in accident prevention unassisted.

So from both the social and economic viewpoint, it should be the duty of some responsible officer to undertake, if only on a part-time basis, the work of organizing systematic education in safe working practices and operating procedures.

Size a Factor

The form which this training should take and the extent to which the modern policy of employing full time safety personnel might be applied, will depend on the company's size, facilities and operational requirements. Expert advice is available from the National Safety Council in detailed information on methods of investigation, recording and analysis of accidents, compiling injury statistics and application of data obtained to a particular safety program.

Management must be interested, assume leadership and formulate a sound framework upon which specific plans can be built and detailed rules and instructions based.

Rules can be enforced. Cooperation will depend largely on the methods of presentation by safety organizers. Cooperation cannot be enforced. It cannot be bought. It has to be earn-

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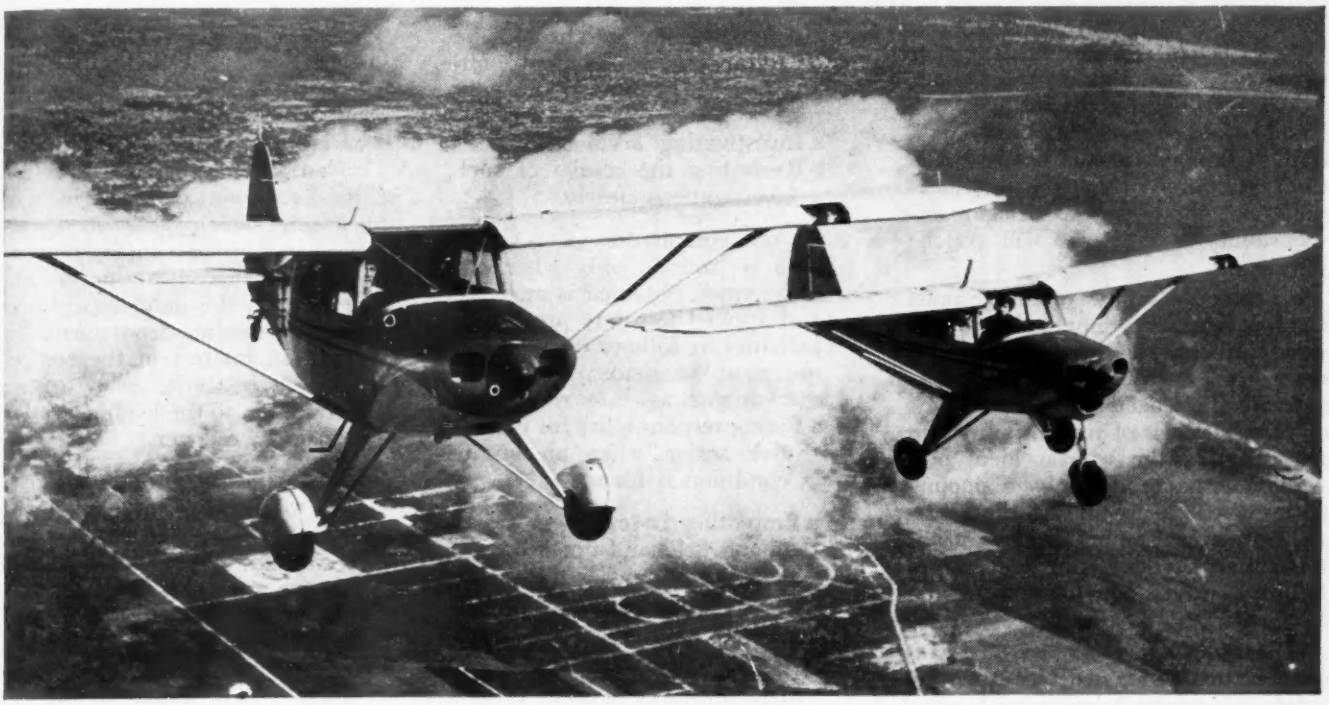

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ed. It will be earned when it is demonstrated through leadership that the management is entitled to respect and cooperation. When employes are ready and eager to accept leadership and instructions, well-controlled, efficient operation will result.

An effective way for management to achieve cooperation in safety matters is to form a committee of men qualified to instruct, demonstrate and lead. "Qualified" should not be taken to mean purely academic qualifications, but the ability to delegate responsibility to men who will get the job done.

An effective safety committee must be representative, not only of the varied processes of the operation under consideration, but as far as possible should reflect the point of view of varying levels of responsibility and authority. In this way accident prevention is made easier by a pooling of resources, by obtaining the assistance of several points of view of administration, engineering and operations executives, field supervisors and foremen.

The assistance of hourly-paid employes can be obtained by promoting safety suggestion schemes with some form of incentive basis, preferably a monetary reward for good suggestions, and, where practicable, by group discussion.

Basic Principles

Though conditions are seldom identical in different organizations, some basic requirements for the promotion of accident prevention are outlined below. The emphasis is on basic rules rather than detail; if the methods are fundamentally sound, successful results can be achieved though details may vary.

1. Management must recognize that safety is not something to be picked off the shelf like a pound of tea; is not just a matter of a few fragmentary, disconnected decisions or a printed circular or two. There has to be not merely interest and participation, but active leadership, a clear, stated pattern of procedure in the application of safety regulations—not a retreat from one crisis to another, fixing policies and principles to the change of each day. Management must accept responsibility for not only setting up accident prevention machinery, but seeing that this machinery functions effectively. The guiding principle should be to make the field or plant a better place to work.

2. In the application of safety, a lot is learned by mistakes. It is essential to record mistakes when an accident is investigated. Decisions and action should be based on facts. It is therefore important to institute machinery for:
   a Investigating accidents.
   b Recording the results of such investigations clearly.

3. As the compilation of accident data is justified only when the information obtained is analysed and applied to safety prevention activities, it follows that definite use must be made of accident records such as:
   a Fixing responsibility for corrective action when an unsafe condition is found.
   b Promoting interest in safety among field and operating officials by supplying them with information on the accident records of their departments.
   c Determining the leading accident problems in order to provide field supervisors and safety committees with information in regard to the most frequent unsafe practices and conditions thus enabling them to concentrate their time and effort where most needed.
   d Assessing the effectiveness of the safety program by determining whether the injury record is improving or getting worse, and to compare results with those of similar operations elsewhere.

4. Having established the main causes of accidents by means of recording, it logically follows that the information obtained should be passed on to the men most directly concerned in those operations. Safety promotion should be introduced according to the size and scope of operations, and may take the form of talks by foremen and supervisors and safety letters by executives, organized lectures, safety posters and films.

5. Such promotion should be integrated with a policy of providing adequate protective equipment for the various operations. That failure to use protective equipment provided, or to observe specific precautionary instructions issued, should be met by rigid disciplinary action, will be readily appreciated by management and employes to be a matter of common sense.

6. Accident prevention work can be stimulated by inter-departmental competitions. Such competition is usually based on the rate of injuries sustained in the various departments and is held on an annual basis. Awards are usually to winners in the form of a trophy which is inscribed with the name of the winning department and placed in a permanent position in the main office until won by another department. To maintain interest in the competition, it is a good plan to give recognition to the leading section quarter by quarter.

7. Safety education should be relevent to the work actually being done, and should be factual, fresh and arresting. It should give the men carrying out the details of operations a renewed awareness of the fact that a bad accident record is a bad operational record. Safety should not be viewed as something separate from the operation under consideration—it is an integral part of the progress of getting something done with system, efficiency and economy.

The provision of machinery for enlisting the cooperation of personnel of all levels of authority, and of providing adequate facilities for the promotion of ideas, is an essential requirement for a healthy industrial organization, not only for advancement of accident prevention but from the viewpoint of achieving those standards of efficiency and output which will assist the industry.

Finally, for all who share some degree of responsibility for the working conditions of people in the oil industry, there is a clear obligation to maintain a continuing effort toward accident prevention. In the years ahead personal incomes will permit higher standards of education and of living. Employes will want better working conditions than in the past and they will be justified in wanting a safe place to work. Advancement toward these aims in the oil industry will be assisted by safety education and its practical application.

ACKNOWLEDGMENT

The author expresses thanks to the Institute of Petroleum for permission to publish this article.

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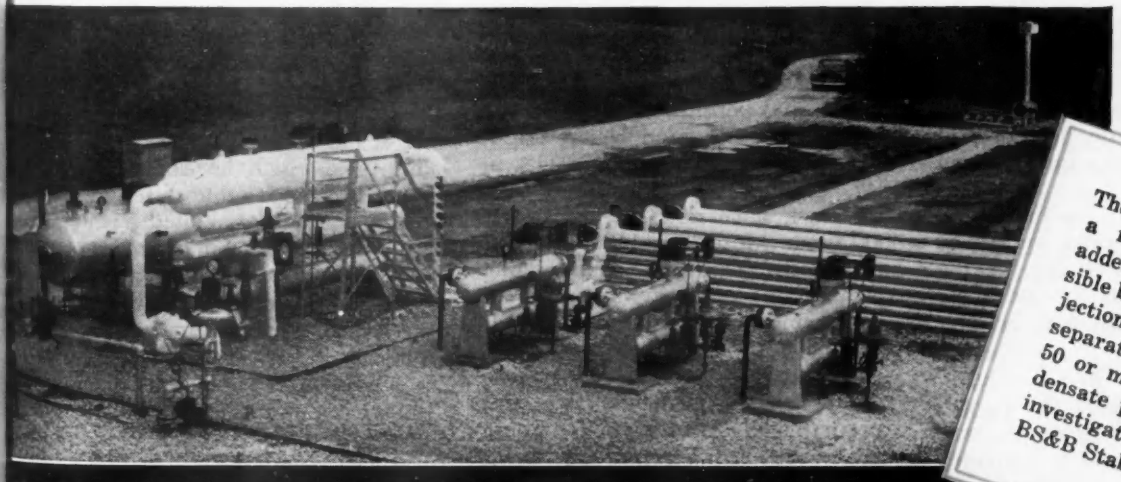

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Employes Gripe, They Listen

Hearing a man out has done so much good that it's now part of this company's policy.

By AL REESE
WORLD OIL Staff

He helps people to explode.

He is R. L. B. Roessle, head of Employe Counseling Service for Standard Oil Company (N.J.).

He is a safety valve for the angry, a stimulant for the bored, an escape for the frustrated, a refuge for the fearful. He is perhaps the industry's most talented listener—and he created his own job.

An adult company in an industry just now emerging from the rugged individualism of brawling adolescence, Jersey Standard has long provided havens for troubled employes. For years Jersey people have been urged to take their problems to the medical and personnel departments and to their own supervisors. But there was a gap in the program. Who will discuss a job problem with his supervisor when his dislike of the supervisor is the very problem? Who will spread his intimate personal secrets before the eyes of a company doctor or personnel man?

Roessle observed this lack, asked and received permission to set up the counseling service, and began listening to people's troubles. That was in 1947, and he and his assistant, Miss Rita Hart, have now listened nearly 3000 times. More than 1500 employes have "blown their tops" about nagging wives, unfair bosses, wayward children. All of them absolutely sure their secrets would never leave the counseling room.

No less vital than secrecy is the voluntary basis on which the talks are conducted. The counseling room door is open to all, but nobody is pushed through it. And nobody receives a gift-wrapped solution to his troubles. He talks; the counselor listens. Then, gently, deftly, he is squared away to his problem.

The counselor's technique for the fearful is to help him confront his difficulty instead of running away. But for the bewildered, it is necessary to explore beyond the apparent difficulty. In one out of five cases the counselors are asked for one form of guidance only to find that the surface problem veils a deep emotional stress. For example, in Roessle's files is this case history of John X.

> "Wants transfer. Hates his boss. On finding out that he also hates his father, it is made clear to him that there may be some relationship between the father attitude and his attitude toward his boss. It is recommended that he talk to his boss, which he does. He finds that his boss is quite different from what he had anticipated. He is still working in that department, and has been advancing steadily."

Counseling sometimes points a path away from employment with Jersey Standard. For example, there was the case of Harry L:

> "Is unhappy in present job. Interests indicate outdoor, mechanical and scientific. He decides after discussing the situation at some length that he will become a veterinary and leave the company."

Many of the cases are less conclusive. The counselee stops the visit, and since the service is purely on a voluntary basis, the real problem is never ascertained. Such was the case of Miss X:

> "Shows great falling off in work output . . . She is advised to take

■ CONTINUED ON PAGE 86

Gas Industry Feels Price Pinch

More income from marketed gas is needed to cover higher cost of production and transportation.

THE gas industry as a whole is feeling painfully the impact of higher wages, higher costs of materials and higher taxes. The sharply higher costs have necessitated increases in prices of natural gas at the wells and have made it urgent that wholesale and retail rates promptly be adjusted upward. The rates must be advanced if the gas industry is to continue to serve the public efficiently.

The need of higher rates by the majority of gas utility companies has been pointed up strongly through studies by the American Gas Association of the cost trends affecting gas utility operations.

While the U. S. Bureau of Labor cost-of-living index at the end of 1951 stood at 189.1 percent of the 1935-1939 average, AGA pointed out, the average cost of residential gas service on the same date stood at only 103 percent of its 1935-1939 average. While living costs in general rose nearly 90 percent, the cost of gas to residential customers gained only 3 percent.

Labor costs for the gas utility industry in 1940 totaled about $249 million. In 1950 the total payroll of the gas industry was $622 million. In 1940 the average wage of gas utility employes was $1730 per year. In 1950 it had risen to $3530 per year, an increase of more than 100 percent in 10 years.

Manufactured gas companies probably have felt the impact of increased operating costs more than natural gas or mixed gas companies. But increased prices at the wells and rising labor and construction costs of natural gas companies are altering this picture rapidly.

Cost comparisons of materials needed to manufacture gas show why many manufactured gas companies changed to natural gas or mixed gas distribution. In 1945 the gas utilities paid $6.90 per ton as the average cost of solid fuels used in manufacturing gas. By the end of 1950 the average cost of these solid fuels was $10.80 per ton. In 1945 the average price of oil for gas making was 4½ cents per gallon. In 1948, the average cost of oil was up to 8½ cents per gallon. In 1950 the average price was down to 6 cents per gallon, partly because of a new gas making process developed under the A.G.A. gas production research program. This enabled gas utilitis to use low-cost bunker oils in making gas. However, some gas utility companies pay as much as 13 cents per gallon for superior grades of fuel oil for gas making today.

Fuel Prices Up

Total fuel costs for manufacturing gas in 1940 amounted to 5.4 cents per therm, compared with 7.5 cents per therm in 1950. Fuel costs rose 40 percent in ten years. The total fuel and labor bill of gas utilities for 1940 was about $531 million. In 1950 the same costs totaled more than $1,307,000,000. This was a gain of 146 percent in two of the major operating costs of manufacturing gas in ten years.

Natural gas and mixed gas companies also are combatting rising costs in labor, materials and taxes. They also are affected by the deflated value of the dollar. Today they face higher financing costs when they have to raise funds for expanding plant and facilities. One company obtained new money at 2.83 percent interest in January, 1951. Today, companies in the same bracket are paying around 3.45 percent for borrowings.

Several important manufactured gas companies converted to natural gas distribution in the past few years to escape from the inevitable rising cost of gas-making fuels. But the savings through lower manufacturing and distribution costs through conversion are being dissipated as the cost of natural gas to the gas utility company is rising steadily. Natural gas producers and pipe line companies have encountered increased costs of doing business that they must pass along to their customers, the transmission or distributing companies.

Louisiana, Oklahoma, Texas and some of the other gas-producing states have imposed production taxes on all natural gas or oil drawn from wells. These taxes are in addition to the millions of dollars of federal, state and local taxes paid yearly by gas producers. Some states have initiated gathering taxes for natural gas; other states propose similar imposts on natural gas produced within state boundaries.

Drilling Costs Rise

Drilling and exploration costs, so necessary if our natural gas reserves are to keep ahead of sharply increased production, have risen sharply. Today the average cost of a wildcat, a well drilled in an unproved area, is about $90,000. There is only about a one-in-nine chance of recovering the $90,000, and only about a one-in-40 chance of making any substantial profit on the venture.

Many producers believe low field prices discourage conservation of natural gas. Fair prices are needed to compensate producers for gathering

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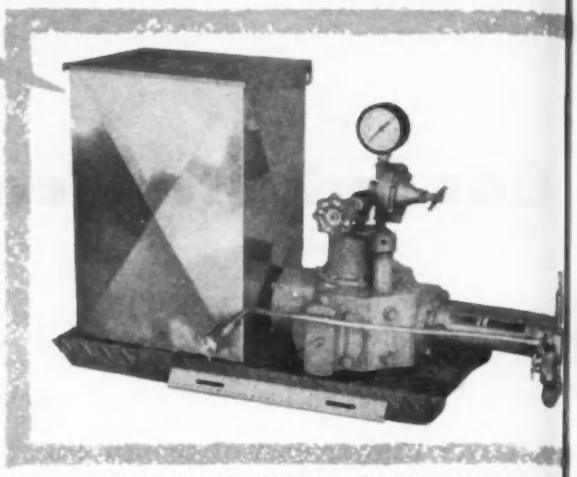

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. . . operates smoothly and quietly on a 4-cylinder rotary crankshaft motor, which is completely bathed in oil. The adjustable plunger, operated at 60 rpm, will inject from ounce to ten gallons of fluid per day against pressures in of 10,000 p.s.i. Other plunger sizes available.

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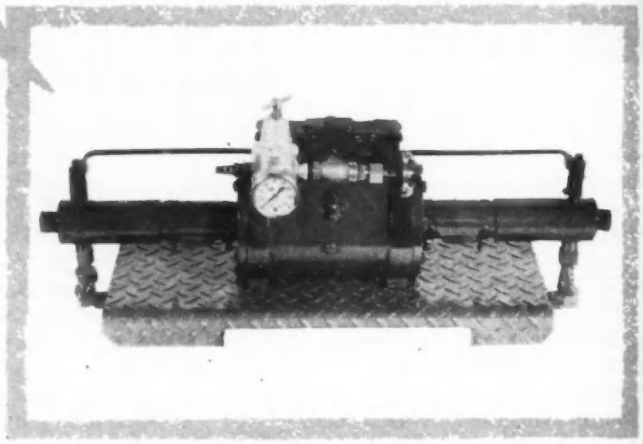
- TEMPERATURE HAS NO EFFECT ON OPERATION OR ACCURACY OF PUMP
- MOTOR RUNS COMPLETELY IN OIL
- SPECIAL CHEMICAL ENDS FOR HANDLING ALCOHOL AND ANTI-FREEZE
- ACCURACY OF METERING OF THE FLUID, ADJUSTABLE STROKE
- SELF STARTING. PUMP HAS NO DEAD CENTERS
- OPERATES ON LOW GAS PRESSURE



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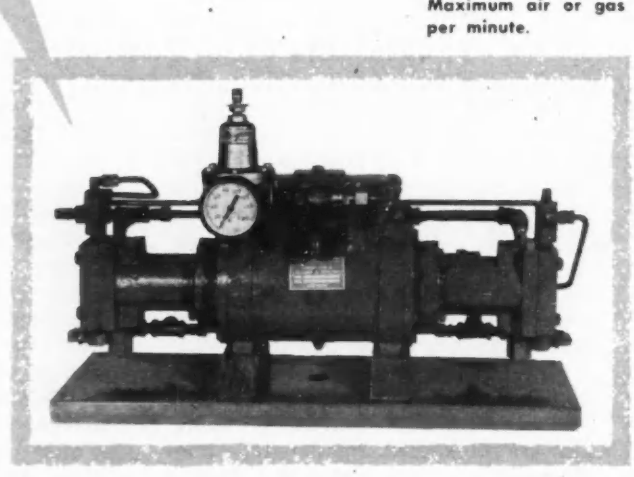
. . . is especially suitable for chemical slugging and for high volume chemical injection into oil and gas lines. The MAC-24 pump is light, compact and portable. The standard unit has two chemical ends compounded, but it is available with a single end. Maximum air or gas consumption of MAC-24 is 44 cubic feet per minute.



MAC-24 HYDROSTATIC TESTING

. . . an ideal test pump for air or drive. Because of its light weight it is cially useful for testing lines and va around refineries and plants. Power inders are 4" diameter, 2" stroke, 2" primary and 5/16" secondary plung The MAC-24 will pump 8.2 gallons minute to 355 #, then automatically sw to secondary stage, pumping 0.199 G to 14,200 p.s.i. Other plunger sizes available.

Complete information will be furnished upon request by writing . . .

SALES DIVISION

AVAILABLE THROUGH LEADING SUPPLY STORES

McFARLAND ENGINEERING & PUMP

1206 NANCE HOUSTON, TEXAS PReston 4101

the casinghead gas which formerly was flared at the wells. A few years ago producers averaged about 60 cents per well per day for gathering casinghead gas. Greatly expanded markets and huge pipe line systems today make it profitable to transport this casinghead gas to distant markets. The volume of flared or wasted gas today is less than 10 percent of total production at those fields where it formerly was burned.

The pipe line companies are facing sharp rises in operating and construction costs. New pipe line systems are stretching across the nation, further and further from the source of supply. Costs of delivering gas increase in direct proportion to the distance the fuel is transported. The cost of constructing pipe lines has increased more than 85 percent during the past ten years. Companies that figured an average cost of $1000 per inch mile for pipe line construction in 1941, now have to estimate between $1850 to $2500 per inch mile for similar lines.

Ten years ago well-head prices for natural gas averaged 4½ cents per thousand cubic feet. Today new contracts call for 12 cents and 13 cents per Mcf. Although the long-term average field price is about 6 cents per Mcf because of the many older contracts still in effect, pipe line companies find it impossible to purchase gas on new contracts at less than 10 cents per Mcf. One large producer has set 15 cents per Mcf as its field price on future contracts.

Cases Before FPC

The Federal Power Commission has pending rate increases petitioned by pipe line companies totaling more than $100 million in addition to rate increases granted in 1951. Pipe line companies, as yet, have not passed along all increased costs to the gas utility companies. The average cost of gas sold to gas companies for resale has risen only from 16.8 cents per Mcf in 1946 to 17.25 cents per Mcf in 1950.

This average can be expected to increase sharply. Gas utility companies converting to natural gas now are located great distances from the fields and must pay for increased transmission costs. New areas are to be opened in New England and in the Pacific Northwest, far away from gas fields. New high prices on contracts for these markets will lift the national average. Escalator clauses in recent contracts calling for specific increase of two cents or more per Mcf at stated intervals like five years, will tend to lift the average cost to utility companies.

The problem of rising operating costs is not geographical. The A.G.A. studies showed that the gas industry as a whole faced higher wages, higher cost of materials and higher taxes. Experiences of various companies were cited.

The Washington (D.C.) Gas Light Company stated in petitioning for a rate increase that through converting to natural gas it had avoided large capital expenditures for plant expansion. It had eliminated inflationary rises in costs of coal, oil and other gas-making materials. By retarding operating costs it had succeeded in holding gas rates for ten years at the 1942 level.

Today higher wage levels, higher taxes and price increases on materials have more than offset economies effected through conversion to natural gas. The wholesale cost of gas to the Washington company was increased last year by nearly $1 million. The company's supplier has petitioned another rate increase that would add another $800,000 to fuel costs. The company was caught in a squeeze and had to apply for a rate increase to permit a fair return on money invested in the company.

The Peoples Natural Gas Company of Pittsburgh faces increases of more than $2 million in operating costs. The increased costs include $1,133,000 rise in the price of gas purchased from southwestern areas; $830,000 in additional federal and state taxes; $230,000 increase in cost of local gas purchases; and about $250,000 a year in additional payroll costs. The company is petitioning for an overall increase of about 18 percent in average residential and commercial rates over the 1941 average.

Since 1941 the company points uot, consumer prices of bituminous coal have jumped from $5.10 per ton to $10.60 per ton in the Pittsburgh area. This is a gain of 107.8 percent. Egg coke has risen from $8.25 a ton to $18.50 a ton, an increase of 124 percent. Fuel oil has risen from 7.5 cents per gallon to 13.15 cents per gallon, a rise of 75 percent. Against these increased costs of competitive fuels, the gas company asks an 18 percent increase.

Inequities in competitive prices of household fuels have created heavy demands for gas services on companies like the Ohio Fuel Gas Company, Columbus, Ohio. The company estimates it cost $89 to heat an average home in Columbus in 1950 with natural gas. Heating the same house by coal cost $142 and the cost of heating by oil would be $208. Natural gas, a premium fuel, is priced below competitive fuels in many parts of the country.

The Portland (Oregon) Gas & Coke Company has petitioned a rate increase to meet heavier labor, pension and tax costs. On the basis of 1951 earnings, the company's rate of return on its invested capital was less than 5 percent, though commissions regard 6 percent as a fair return. Compensatory rate relief is necessary to enable the company to meet financial obligations and to operate on a sound economic basis, company officials said.

The Southern California Gas Company has held gas rates fairly stationary for the past ten years, though practically all other living costs have risen 50 to 200 percent. Wages paid by the company are up 110 percent since 1940; cost of gas purchased has risen 75 percent; and federal income taxes have more than doubled. A few years ago, the company points out, new money for small construction programs could be borrowed at cheap rates. Now construction requirements have grown so that the company has to finance with both bonds and stock at about 50-50 ratio. The combined annual cost today, including income taxes, has about quadrupled, necessitating a petition for higher rates.

230 Percent Jump

The Pacific Gas & Electric Company, San Francisco, in a successful petition for a gas rate increase recently, showed that gas department labor costs for maintenance and operation for the first six months of 1950 were 230 percent of similar costs in the first half of 1940. The average price of 4½-inch pipe rose 177.5 percent from 1940 to 1950. The price for tank plate rose 35.2 percent from 1940 to 1950, while the price of one type of gas meters rose 99.9 percent in the ten-year period.

The Columbia Gas System in the past six years has spent millions of dollars for new facilities and services to meet expanding demands and to stabilize operating costs. Expenditures include $268,000,000 or $107 per customer for new service and transmission facilities and $50,000,000 for development of underground storage and cushioning depleted fields with gas.

But even such tremendous investments and the economies they produced cannot cancel the rising costs of materials and supplies. Columbia pays $123 a ton for pipe it bought

for $51 in 1940, a rise of 225 percent. A gas meter cost $8.40 in 1940, today it costs $18.80. The cost of a half-ton truck has climbed from $591 in 1941 to $1461 today. The cost of drilling a gas well has tripled since 1931 and more than doubled since 1941 in the Columbia System. The composite hourly labor rate has more than doubled in the past ten years.

Even the new pipe line companies feel the pinch of rising costs. The Transcontinental Gas Pipeline Corporation has been in existence less than three years, yet it had to petition the Federal Power Commission for rate increases totaling about $13,650,000. Since 1949 the company's tax rate rose from 38 percent to 52 percent. Texas recently added a gathering tax of 9/20ths of a cent per Mcf on pipe lines. In three years state, local and other taxes have risen about 5 percent. Average weekly wages in the gas utility industry have risen from about $64 in July, 1949 to $71.75 in August, 1951. Being a new company Transcontinental believes its labor costs rose even a greater percent.

C. T. Chenery, chairman of Southern Natural Gas Company recently told a group of New York Security Analysts that users of natural gas would have to pay higher prices in the next few years. His company pays an average of 6.53 cents per Mcf for the gas it buys. This average derives from prices ranging from 4.62 cents to 11.90 cents per Mcf. The average resale price is 18.75 cents per Mcf. Taxes add about 4 cents to the average cost of 6.53 cents per Mcf leaving a net of 8.25 cents to cover operations including transporting gas from the wellhead to customers.

Out of this margin must come any return to stockholders on more than $100 million invested in plant and facilities. Any increase in costs narrows that margin to the point where increased rates are necessary. This situation is typical of most companies in the gas industry today. Rising costs have narrowed profits to a point of no return. Each increase in the cost of doing business now must be passed on to customers or financial credit of the companies would be impaired. With new money needed to finance the $4.5 billion dollar construction program ahead of the gas industry for the next five years, credit must be maintained. Regulatory bodies are aware of this fact and generally are inclined to help gas companies earn a fair return on invested capital needed to attract investors.

Employes Gripe, They Listen

■ CONTINUED FROM PAGE 82

some YWCA courses and increase her circle of friends. Actually, the counselor did not feel at the time that there had been movement on the case. However . . . she has been showing consistent improvement . . . This is a case where the dynamics are not observable. We only recognize that something occurred in the counseling situation to enable her to make a better adjustment to the job situation."

For convenience, Roessle divides employe problems into five classifications:

- Vocational—on the job.
- Personality adjustment — where there is a minor psychological difficulty.
- Pre-retirement — for those who will soon be retiring.
- Information—for those concerned about jobs in general, company politics, etc.
- Supervisory counseling — to help supervisors with any unusual personnel problems.

Age, sex or length of service seem to have no bearing on the degre to which people need help, says Roessle. The only noticeable trend is that the younger age groups are, quite logically, more concerned with vocational and educational problems, the categories which embrace about 57 percent of the total interviews.

Older people who go to Roessle and Miss Hart have usually made adjustments in their working lives. Often they are just plain bored with a routine task which arouses no job pride, gives no satisfaction of achievement. Or sometimes they are lonely, often because of the loss of husband, wife or parent. The solution to either problem can be the stimulation of a hobby, cultural pursuit or social activity.

The counselors occasionally hear problems which are referred to outside agencies better equipped to handle them. Marital difficulties, for instance.

Roessle and Miss Hart make no effort to divide the cases between themselves according to types of problems or the age or sex of the customer. An exception is the pre-retirement problem, usually handled by Roessle.

ROBERT L. B. ROESSLE was born at Albany, N. Y., Aug. 8, 1897, and started in business as an office boy with a shipping concern. He enlisted in the Navy in World War I and became an ensign before the close of the war. In 1921, he started with Jersey Standard and went to Norway with one of the Norwegian subsidiaries. Within a few years he became manager of a Standard affiliate in Norway and after 16 years returned to the parent company in New York to become head of the Overseas Personnel Office, and then joined Foreign Marketing Coordination.

His position of adviser on employe development includes the counseling activity and the promotion of various employe relations techniques.

RITA V. HART was graduated from New Jersey State Teachers College in June, 1943. She began her business career in a clerical position with the Federal Reserve Bank of New York. Shortly thereafter she was appointed education counselor. Realizing the need for additional psychology training, she, herself undertook an evening program toward a master's degree in vocational guidance at Columbia University, which she completed in June, 1949. She subsequently completed some courses toward a Ph.D. in psychology at Fordham University.

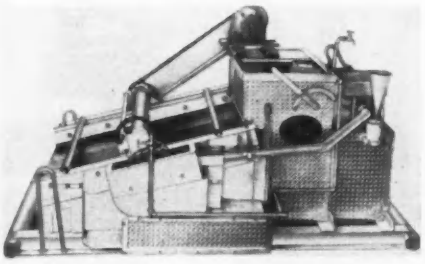
Roessle has no statistics which chart counseling successes against failures; if he followed up his cases he would destroy the confidential nature of the service. But on the whole, he believes most of his customers have gone away satisfied, and sometimes they tell him so later.

"Sometimes," he says, "it's just a cheery voice on the telephone saying 'Just thought you'd like to know I got that promotion.' That in itself may mean the happy ending to a case which just a few weeks ago was all tears and woe. And such a phone call is enough to make it all worthwhile."

NEW AND IMPROVED EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

KEEP INFORMED by requesting additional information on new equipment and services described on this and following pages. SAVE TIME by using one of the free and convenient Reader Service Postcards on opposite page. Circle number on card corresponding to the number listed at the end of each new equipment item on which you desire additional information.



Vibrating Shale Shaker

A new vibrating-type shale shaker is in production by Thompson Tool Company. Among new and improved features is a sample machine which is incorporated as standard equipment on each shaker, giving a foot-by-foot analysis of the progress of the well. Lifting bails make moving and picking up much easier and faster. A wash basin is an innovation for these machines and is useful for washing off tools as well as the operator's hands. A stationary water spray, for washing down screen, and a tool cabinet built into the back of the shaker for storage of samples, sample bags and mud tools are other special features.

This item supplements Thompson Tool Company data on pages 4870-4876 of Composite Catalog, 18th Edition.

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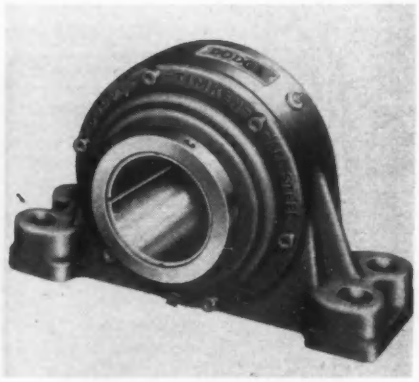

Pillow Blocks

A new line of all-steel pillow blocks with high load-carrying capacity is offered by Dodge Manufacturing Company. The bearings are a joint achievement of Dodge and Timken Roller Bearing Company, working together to design a pillow block with high radial and thrust capacities and stamina to take heavy-shock loads. The bearings are fully self-aligning, with spherical outer race. They are available in both expansion and non-expansion types and have an adapter mounting. Double piston ring seals keep lubricant in and dirt out of the bearing mechanism.

This item supplements Dodge Manufacturing Corporation data on pages 1431-1434 of Composite Catalog, 18th Edition.

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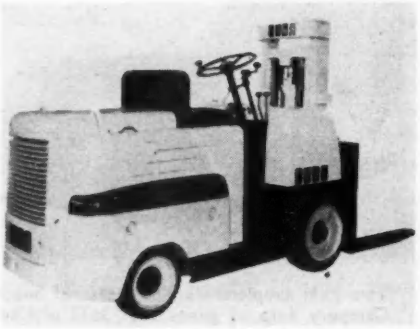

Fork Lift Truck

The Buda Company now has available a 600-pound capacity fork lift truck in two models: gasoline powered model FT60-24 and diesel powered FTD60-24. The new trucks are rated at a 24-inch load center. Model FT60-24 is powered with a Buda 73½ horsepower, six-cylinder gasoline engine and is available as optional equipment with a four-cylinder, 53½ hp engine. A six-cylinder Buda diesel engine with a 230 cubic inch displacement is standard for model FTD60-24 with an optional four-cylinder, 182 cubic inch displacement diesel engine.

This item supplements The Buda Company data on pages 926-931 of Composite Catalog, 18th Edition.

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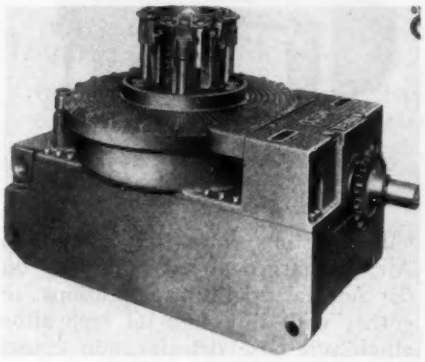

Rotary Machine

A rotary machine with fully enclosed, built-in air slips is offered by The National Supply Company. Ideal Type 205 Multimatic Rotary Machine has a 20½-inch table opening and is designed to handle casing strings as well as drill pipe. Insert slips take drill pipe up to 5½ inches and casing up to 9⅝ inches by means of wicker inserts which can be replaced within a few minutes in the same slip bracket. To set 10¾-inch casing, air-operated slips of the plain wicker type are used. Larger diameter casing strings may be handled by conventional casing spiders. The new Ideal direct-drive roller kelly bushing is driven directly from the table through three integral lugs that fit into recesses in the table top.

This item supplements The National Supply Company data on pages 3501-3622 of Composite Catalog, 18th Edition.

Circle No. 16 on Postcard

Portable Compressor

Three new sizes have been added to Ingersoll-Rand's line of Gyro-Flo portable compressors. The introduction of 315, 210 and 105 cubic feet per minute units makes the rotary sliding-vane design available for a wide range of operating requirements. The two-stage, oil-cooled, rotary sliding vane compressor design eliminates

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

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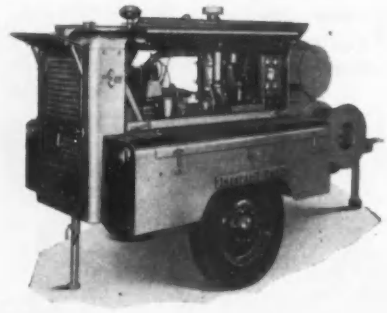
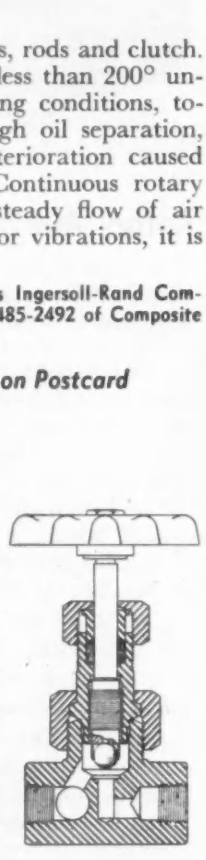


valves, pistons, rings, rods and clutch. Air, discharged at less than 200° under normal operating conditions, together with thorough oil separation, eliminates hose deterioration caused by heat and oil. Continuous rotary action provides a steady flow of air without pulsations or vibrations, it is claimed.

This item supplements Ingersoll-Rand Company data on pages 2485-2492 of Composite Catalog, 18th Edition.

Circle No. 17 on Postcard

Ball Valve



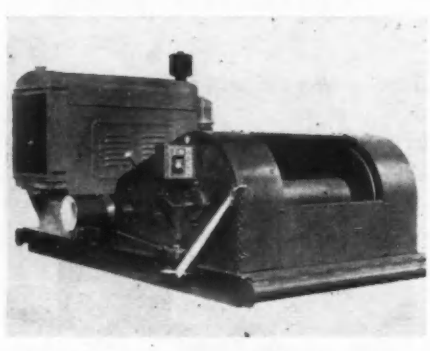
A new quarter-inch ball valve for working pressures up to 3000 pounds per square inch is offered by The Foxboro Company. Tight shutoff is provided by a stainless steel ball which closes into a machined, conical seat. The ball, retained at the end of the stem, is free-rolling, so that every closing brings a new surface into contact with the valve seat. Alignment of ball to seat is piloted by a forged steel, union-type bonnet, fitting tightly to the body and assuring a correct valve closure. Long-stroke stem and packing gland are made of stainless steel, and the packing is preformed, graphited asbestos with a plastic binder.

This item supplements The Foxboro Company data on pages 1753-1768 of Composite Catalog, 18th Edition.

Circle No. 18 on Postcard

Servicing Rig

A compact, portable rig, designed principally for well servicing but also suitable for shallow drilling, has been announced by The National Supply Company. The Ideal Type T-8 Hoist will normally be used for servicing jobs in the 2000- to 4000-foot depth range. However, an optional rotary drill attachment adapts it for drilling in the 1000- to 2000-foot range. The rig can be powered by either a torque converter equipped engine or by an engine equipped with an automotive type four-speed transmission. The engine throttle and clutch controls are air operated. The rig can be truck mounted, and removing the two catheads brings over-all rig width to less than eight feet.



This item supplements The National Supply Company data on pages 3501-3632 of Composite Catalog, 18th Edition.

Circle No. 19 on Postcard

Tubing Head

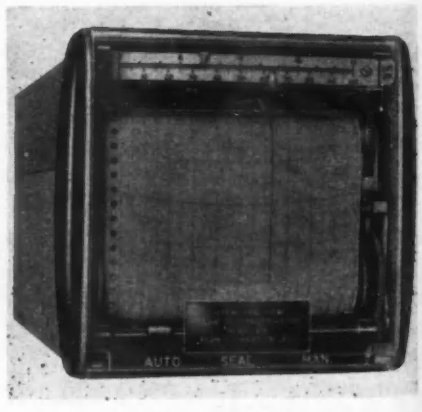
A new threadless stubby tubing head introduced by Alten Foundry and Machine Works, Inc., similar in construction to the firm's threaded stubby, is made to meet the demand for a threadless, slipover type. It packs on tubing or coupling and is available as split or solid gland. Its squatty design brings wellhead equipment low.

This item supplements Alten Foundry and Machine Works, Inc., data on pages 189-208 of Composite Catalog, 18th Edition.

Circle No. 21 on Postcard

Panel Instruments

The Foxboro Company's new Consotrol line of compact indicators, recorders and controllers comprises four distinct instruments: Models 52, 53, 58 and 59. Model 52 controller has a four-inch indicating scale and a continuous valve position indicator. Model 53 recorder illustrated, uses a full four-inch strip chart to provide a 30-day process record on a single roll. The model 58 controller uses a "floating disc" force-balance system which permits adjusting the proportional band from zero to infinity. Model 59 controller is mounted directly on the valve motor to control liquid flow.



This item supplements The Foxboro Company data on pages 1753-1768 of Composite Catalog, 18th Edition.

Circle No. 20 on Postcard

OTHER NEW AND IMPROVED EQUIPMENT

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Truck Chassis

A new model Sterling - White chassis for oil field operations was announced by White Motor Company's Sterling division. The Model SB 3255D is engineered to handle drilling rigs and other heavy oil field machinery, with a 200-horsepower diesel engine providing the power. Dual transmissions, a four-speed main and three-speed auxiliary, give the operator a wide selection of gear ratios. Top speed is 42 miles per hour in overdrive, and, with both transmissions in low gear, total reduction is more than 120 to 1, resulting in a road speed as low as 2½ miles per hour at full engine-governed speed. The dual rear axle unit has a suspension system for carrying heavy loads over rough roads. Equalizer beams below the rear spring provide for even distribution of the load, regardless of bumps.

Circle No. 22 on Postcard

Undercoating

A new industrial undercoating meeting the requirements of Federal Specification TT-C-520 is made by Minnesota Mining and Manufacturing Company's Adhesives and Coatings division. The coating, a tough, sprayable black-asphalt material called EC-1189, is designed to protect underbody parts of transportation equipment from corrosion and abrasion, and for various industrial anti-corrosion, weathering and sound deadening jobs. When sprayed or brushed to a ⅛-inch thickness, it dries in about 48 hours to form a tough, rubbery coating.

Circle No. 23 on Postcard

Hard Facing Electrode

Wallex No. 2, made by Wall Colmonoy Corporation, is a hard facing electrode giving a deposit material consisting of chrome, manganese, silicon and iron alloy. The deposit is abrasion and shock resistant and has stainless qualities approximately equal to type 410 stainless steel, the manufacturer claims. The deposit has a hardness ranging from 49 to 53 Rockwell C. The electrodes are available in ⅛-, 3/16-, and ¼-inch diameters, by 14 inches long.

Circle No. 24 on Postcard

Anti-Rust Paint

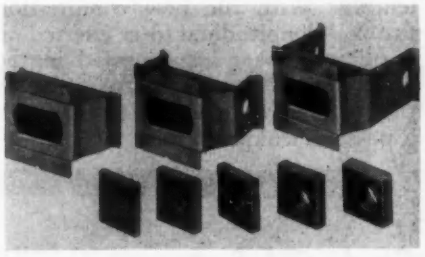
Addition of a new aluminum anti-rust paint to the PCA paint line was announced by Paint Corporation of America. PCA-102 aluminum paint is made of doubly pigmented aluminum mixed with a clear base vehicle. The base is the same as PCA-101, a clear rust inhibitive. The clear base assures a bright appearance, and is said to permit good leafing of the aluminum flakes to form a moisture-proof coating. The paint can be applied by brush or spray over rust, without priming, scraping, wire brushing or sandblasting.

Circle No. 25 on Postcard

Toggle Switch

Performance and operating characteristics of a new hermetically sealed precision toggle switch, developed by Micro division of Minneapolis-Honeywell Regulator Company, are unaffected by environmental conditions. The switch will deliver its full electrical rating and operating characteristics without regard to changes in atmospheric pressure or temperature. Its vapor-proof character prevents condensation on switch contacts. The toggle mechanism provides a detent for both on and off position. The basic switch has a single-pole, double-throw contact arrangement.

Circle No. 26 on Postcard

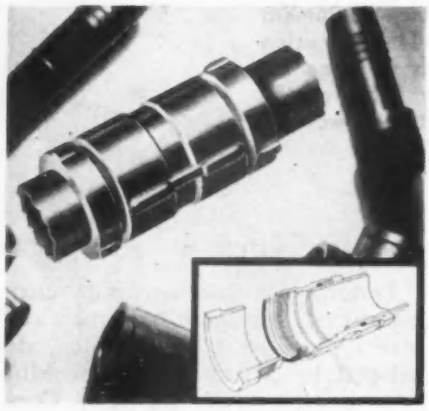


Insert for Concrete

A new type of fully adjustable insert for use in concrete is manufactured by Super-Grip Anchor Bolt Company, Inc. The combination of an elongated hole in the face of the insert and an offset hole in the nut makes it possible to put the nut in the bolt before placing in the insert. The nut can then be adjusted to any point of the compass. The inserts will support a load of 1500 to 2400 pounds. V-shaped notches in the face and two center grooves on the side simplify alignment of the insert in the forms, and four small holes in the insert permit placing it on dowel pins or reinforcing rods.

Circle No. 27 on Postcard

To obtain additional information use convenient Reader Service Postcard on page 89. Circle number on card corresponding to number listed at the end of each new equipment item on which more information is wanted.



Plastic Pipe Fittings

Carlon Products Corporation now offers Carlon "L" rigid plastic pipe and compression type coupling which are said to have increased resistance to burst, high tensile and flexural strength, resistance to chemicals, and ability to withstand sunlight. The material has an ultimate tensile strength of approximately 6000 pounds per square inch and an effective tensile for piping applications of 3600 psi at room temperature. The pipe is available in 10- and 20-foot lengths. With the new compression fitting, a longitudinal force exerted on a rubber gasket incorporated in the fitting creates a secondary force at right angles to the first to maintain a positive leakproof joint.

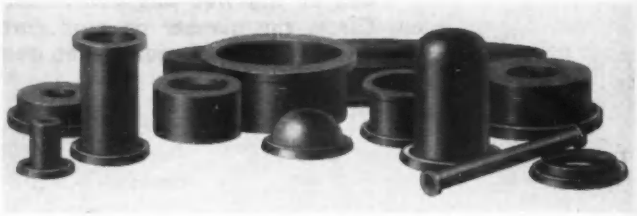
Circle No. 28 on Postcard

Crude Oil System

Crude oil systems for the D397, D386, D375 and D364 Industrial and Electric Set engines are now available from Caterpillar Tractor Company. Included are non-corrosive fuel priming pump groups, field transfer pump groups and fuel injector groups. Fuel must be made relatively clean, wax-free condition by means of settling tanks, pre-filters or centrifuging. Standard engine filters can be used where waxing conditions do not exist. Series 2 lubricating oils, used with crude oil fuel systems, permit use of any clean crude oil available. A specific application of the crude oil system is in pipe line pumping in which fuel oil is taken directly from the pipe line.

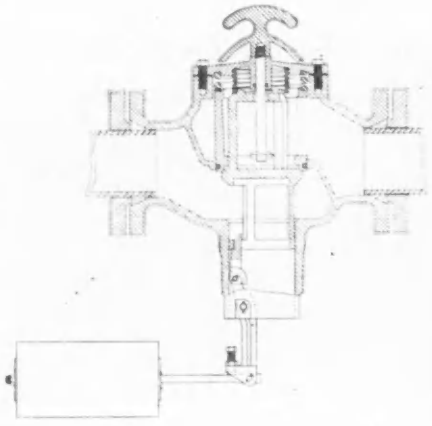
Circle No. 29 on Postcard

Piston Seal



HydroSeal, a one-piece molded elastic piston seal, used as an alternate for diaphragm or piston operated valve, is a new product of Farris HydroSeal Corporation. The leakproof movable seal for all pressures and strokes is made of natural rubber, Buna-N, Butyl and other synthetics. The seal has a circumferential holding method which uses a peripheral bead for pressure tightness. HydroSeal can be designed to include a return spring rate. By variations of wall thickness or varied compounding of the rubber-like material, the seal can be designed with given rate for return strokes, eliminating the springs, counterweights or other devices needed to return the piston or diaphragm to a beginning position.

Circle No. 30 on Postcard



Tank Transfer Valve

The semi-automatic tank transfer valve manufactured by McCartney Engineering & Research Corporation is completely assembled before being installed in the tank. The valve is installed by inserting the float assembly through a regular four-inch coupling and screwing the valve in place. In operation, the cocking handle is lifted until the latch is engaged, then the handle is pushed back down. With the valve in the cocked position, the flow is directed into the tank and at the same time is prevented from flowing on past the tank being filled. When the desired fluid level is reached, the float automatically releases the latch and the valve closes the opening into the tank. To bypass any tank, the valve is left closed.

Circle No. 31 on Postcard

Centrifugal Compressor

A new centrifugal compressor has been developed by Sawyer-Bailey Corporation for handling gases in high pressure systems operating at 600 pounds per square inch and higher. The compressor is said to operate efficiently at flows as low as 125 cubic feet per minute. A built-in lubrication system insures an oil-free flow of gas, as the impeller requires no lubrication. The design lends itself to pressure differentials up to 50 psi, using a direct connected conventional electric motor. Since the compressor is of the centrifugal type, it is said to be able to handle gases having a high contamination of solids that may be highly abrasive.

Circle No. 32 on Postcard

An Announcement of Importance!

GORMAN-RUPP PUMPS

are now available from

HOUSTON WAREHOUSE STOCK

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MID-CONTINENT and GULF COAST
OILFIELD REPRESENTATIVE
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GORMAN-RUPP PUMPS AND PARTS

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The Gorman-Rupp Company
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NEW LITERATURE

Copies may be obtained easily and without cost by using Reader Service Postcard. Just circle on the card the number at the end of each item in which you are interested. The convenient Postcards are on page 89.

Snap-Action Switches

MICRO, a division of Minneapolis-Honeywell Regulator Company, has published a new 24-page, two-color catalog of snap-action switches. The bulletin covers safety, limit and interlock switches for switching a-c circuits in industrial and commercial applications.

Circle No. 33 on Postcard

Aluminum-Chromium Paint

A four-page bulletin describing Monco-Alochrom aluminum-chromium paint has been issued by The Monroe Company. Printed in aluminum and black and illustrated with photographs and line sketches, the bulletin states that Monco-Alochrom is available in several grades for various surfaces.

Circle No. 34 on Postcard

Torque Converter Rig

IDECO, a division of Dresser Equipment Company, has released a bulletin describing its Hydrair 35 series torque converter drilling rig. The new rig is designed for 350 input horsepower, and is available in single and dual engine arrangement. A special model in the series, the Hydrair 35-DD, has an extra large sandline drum which increases its servicing rating to a depth of 16,400 feet.

Circle No. 35 on Postcard

Heating Unit

The new general catalog of The Thermobloc Division of Prat-Daniel Corporation contains a full-color cutaway illustration of a direct-fired heating unit. Several models are illustrated, and dimensions and specifications are given.

Circle No. 36 on Postcard

Metal Hose

A 32-page illustrated catalong on all types of Chicago Metal Hose has been released by Flexonics Corporation. The catalog covers the full range of Rex-Weld corrugated flexible metal hose, Rex-Tube convoluted hose types, and Rex-Flex stainless steel flexible metal hose. Complete specifications are given. Also covered are coupling types, special assemblies, and installation information.

Circle No. 37 on Postcard

Spectrophotometer

Performance and construction of the Model 21 Double Beam Recording Infrared Spectrophotometer are described in The Perkin-Elmer Corporation's new bulletin. Included also are background sections on infrared spectroscopy and the optical null principle.

Circle No. 38 on Postcard

Gas Engines

Four-cycle spark ignition gas engines of 5, 6, 7 and 8 cylinders, manufactured by Worthington Corporation, are described in a new eight-page bulletin. Pictures and specifications of the Type DDG engines are shown. The engines have a 15-inch bore by 17½-inch stroke in 50 and 60 cycle operation.

Circle No. 39 on Postcard

Seamless Tubing

The Babcock & Wilcox Company has issued a bulletin outlining the differences in methods of production, surface finish, tolerances and costs of seamless tubing finished by the hot finished, cold drawn and "roto-rocked" methods.

Circle No. 40 on Postcard

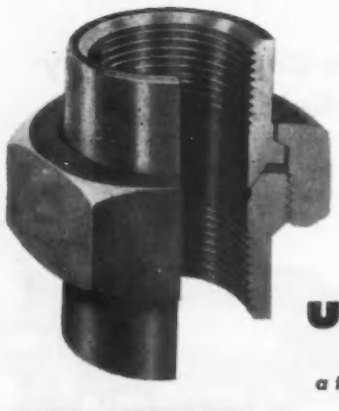
Well Testing Units

Oil Metering and Processing Equipment Corporation has issued a new booklet on its Well Checkers.

Circle No. 41 on Postcard

INSPECTED and TESTED . . .

CATAWISSA UNIONS ARE CAREFULLY INSPECTED AND TESTED WITH AIR UNDER WATER TO ASSURE THEIR HOLDING QUALITIES!



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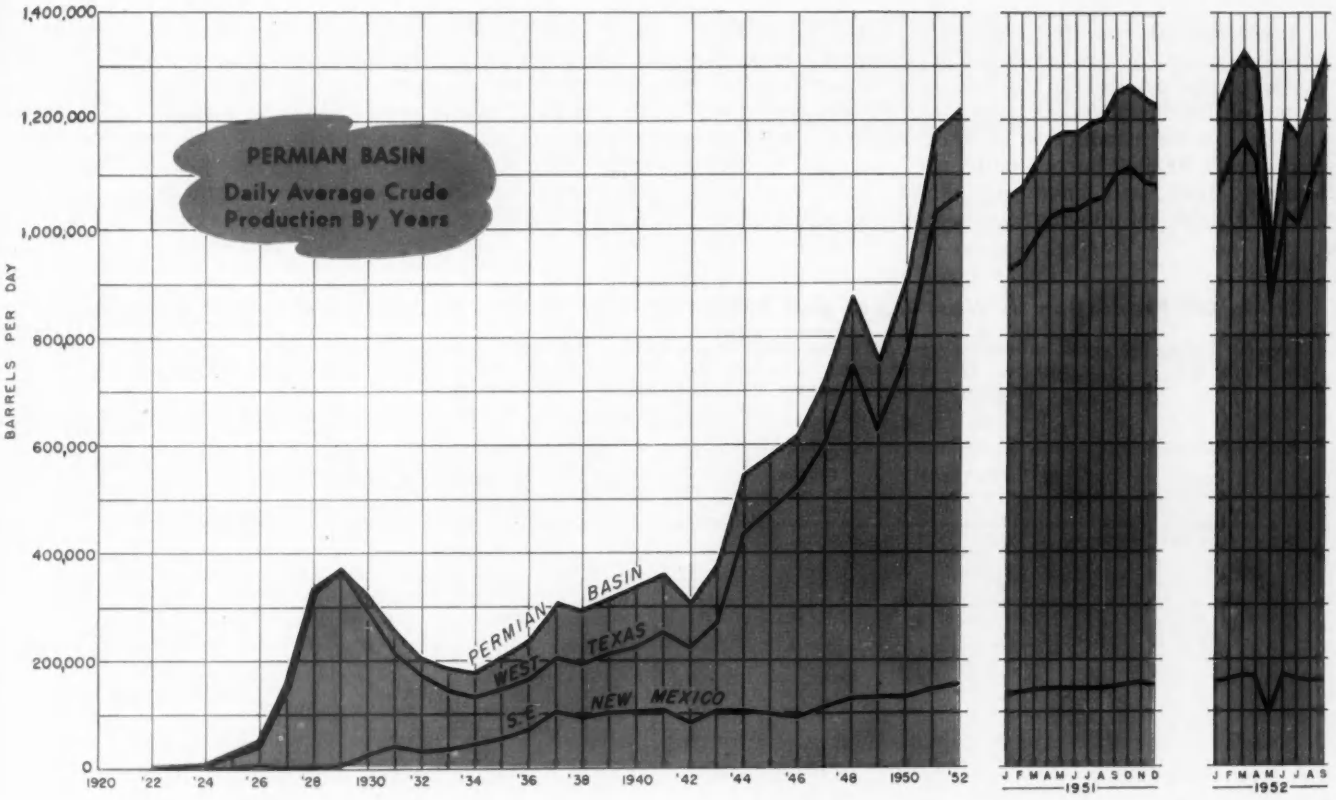
a type for every use . . . all temperatures, all pressures!

CVF CATAWISSA VALVE & FITTINGS CO.
60 MILL ST. CATAWISSA, PENNA.



Permian Basin Production Soars

September output reaches new peak. Area holds rank as the third largest oil-producing province in the U. S.

By L. J. LOGAN
WORLD OIL Staff

PERMIAN BASIN crude oil production increased in September, 1952, to the highest rate on record, extending its traditional rising trend. In the week ended September 6, output averaged 1,320,600 barrels daily, the American Petroleum Institute reported. For the month of September, it is indicated that production will show an average of about 1,332,200 barrels per day, including 1,170,950 in West Texas and 161,250 daily in Southeast New Mexico. The West Texas total includes 173,200 daily in Railroad Commission District 7-C and 997,750 daily in District 8.

The Permian Basin is the third largest oil producing province of the U. S., with the Mid-Continent rating first and the Gulf Coast second. Compared with the 1,320,600 barrels daily produced in the Permian Basin in the first week of September, there was an output of 1,890,800 barrels daily in the Mid Continent, including Texas Districts 1, 5, 6, 7-B, 9, and 10; North Louisiana-Arkansas; Oklahoma-Kansas-Missouri and Eastern Nebraska. The Gulf Coast meanwhile produced 1,594,350 barrels daily, including output of Texas Districts 2, 3 and 4; South Louisiana; Mississippi; Alabama and Florida.

Production of the Permian Basin in the week of Sept. 6, 1952, exceeded that of California and the Rocky Mountain states combined. California averaged 983,600 barrels daily and the Rocky Mountain region 324,500. The Middle West meanwhile produced 277,300 barrels daily and the Appalachian region 50,400, making the U. S. total 6,441,550 barrels per day. Of this amount the Permian Basin's 1,320,600 barrels daily represented 20.5 percent, or a little over one-fifth.

Although already at a remarkably high level, Permian Basin crude production is due to show further substantial increase. Now producing from more different fields and pay zones than ever before, the basin has

at least several hundred thousand barrels per day of producing ability that is not being utilized for lack of market outlet. However, as compared with the current production of somewhat over 1,300,000 barrels daily, the Permian Basin will have pipe line outlets capable of moving out more than 1,600,000 barrels of crude daily upon completion of two large systems now under construction. One of these new lines is the West Texas Gulf Pipe Line Company system, leading to Beaumont on the Texas Gulf Coast and to Longview, Texas, to feed into an eastward bound system. The other line being built is the Rancho Pipe Line System to Houston. Combined capacity of these two new systems eventually will be increased to 615,000 barrels daily. (World Oil, April, 1952, page 55.) If production in this amount should

■ CONTINUED ON PAGE 106

Crude Oil Production in West Texas and Southeast New Mexico, by Years and Recently by Months

Sources: Texas, 1921-1938, private sources; 1939-May, 1952, Texas Railroad Commission; June-Aug., 1952, A.P.I.; Sept., 1952, estimated by World Oil . . . New Mexico, 1924-1946, private sources; 1947-1948, New Mexico Oil Conservation Commission; 1949-May, 1952, U. S. Bureau of Mines; June-Aug., 1952, A.P.I.; Sept., 1952, estimated by World Oil.

(BARRELS)

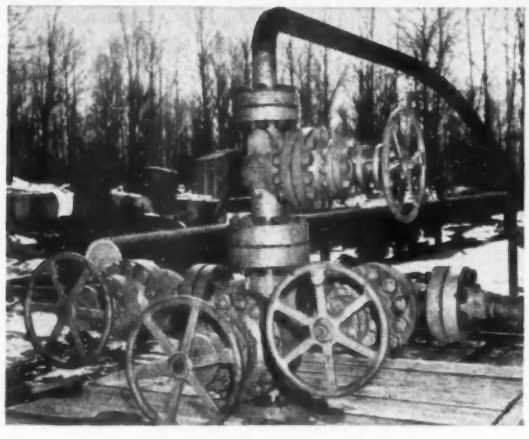
YEAR	DIST. 7-C. TEXAS		DIST. 8. TEXAS		TOTAL WEST TEXAS		S. E. NEW MEXICO		TOTAL PERMIAN BASIN	
	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily
Data by Years, 1921-1952:										
1921	.....	.....	*	*	*	*	.....	.....	*	*
1922	.....	.....	34,010	93	34,010	93	.....	.....	34,010	93
1923	18,425	51	166,145	455	184,570	506	.....	.....	184,570	506
1924	1,078,790	2,947	461,105	1,260	1,539,895	4,207	40,000	109	1,579,895	4,316
1925	8,984,865	24,616	798,895	2,189	9,783,760	26,805	797,859	2,186	10,581,619	28,991
1926	13,477,388	36,924	1,847,856	5,063	15,325,244	41,987	1,097,373	3,006	16,422,617	44,993
1927	17,173,218	47,050	35,273,808	96,640	52,447,026	143,690	632,624	1,733	53,079,650	145,423
1928	12,548,740	34,286	106,867,081	291,987	119,415,821	326,273	709,643	1,939	120,125,464	328,212
1929	10,923,491	29,927	122,355,067	335,220	133,278,558	365,147	1,351,666	3,703	134,630,224	368,850
1930	10,825,044	29,658	97,357,620	266,733	108,182,664	296,391	9,924,331	27,190	118,106,995	323,581
1931	12,173,798	33,353	65,405,130	179,192	77,578,928	212,545	14,750,831	40,413	92,329,759	252,958
1932	10,810,858	29,538	52,274,804	142,827	63,085,662	172,365	11,911,538	32,545	74,997,200	204,910
1933	8,563,843	23,463	45,602,515	124,938	54,166,358	148,401	13,630,263	37,343	67,796,621	185,744
1934	6,782,768	18,583	41,669,772	114,164	48,452,540	132,747	16,440,434	45,042	64,822,974	177,789
1935	6,385,155	17,494	47,625,706	130,481	54,010,861	147,975	19,843,843	54,367	73,854,704	202,342
1936	6,831,500	18,665	53,743,224	146,840	60,574,724	165,505	26,422,595	72,193	86,997,319	237,698
1937	8,374,000	22,942	66,346,000	181,770	74,720,000	204,712	37,968,000	104,022	112,688,000	308,734
1938	8,728,425	23,914	62,677,493	171,719	71,405,918	195,633	35,175,892	96,372	106,581,810	292,500
1939	7,593,250	20,803	70,516,417	193,196	78,109,667	213,999	36,971,183	101,291	115,080,850	315,290
1940	6,837,083	18,680	76,889,195	210,080	83,726,278	228,760	38,574,827	105,396	122,301,105	334,156
1941	6,465,337	17,713	85,989,625	235,588	92,454,962	253,301	39,263,953	107,572	131,718,915	360,873
1942	6,173,779	16,914	75,012,443	205,514	81,186,222	222,428	31,568,860	86,490	112,755,082	308,918
1943	6,521,526	17,867	91,574,233	250,888	98,095,759	268,755	38,487,893	105,446	136,583,652	374,201
1944	7,228,370	19,750	152,874,320	417,689	160,102,690	437,439	39,068,737	106,745	199,171,427	544,184
1945	8,394,014	22,997	167,012,036	457,567	175,406,050	480,564	36,857,998	100,981	212,264,048	581,545
1946	10,075,235	27,603	180,813,239	495,379	190,888,474	522,982	35,282,263	96,664	226,170,737	619,646
1947	13,906,004	38,099	206,514,967	565,794	220,420,971	603,893	40,521,243	111,017	260,942,214	714,910
1948	16,668,257	45,542	259,453,586	708,889	276,121,843	754,431	47,235,804	129,060	323,357,647	883,491
1949	16,807,896	46,049	210,767,351	577,445	227,575,247	623,494	47,310,000	129,616	274,885,247	753,110
1950	20,917,096	57,307	262,985,846	720,509	283,902,942	777,816	47,036,000	128,866	330,938,942	906,682
1951	35,988,102	98,597	341,617,737	935,939	377,605,839	1,034,536	52,815,000	144,699	430,420,839	1,179,235
Total Thru 1951	307,256,257	.....	2,982,527,226	.....	3,289,783,483	.....	721,690,653	.....	4,011,474,136	.....
1952: 1st 9 Months	37,860,929	138,179	254,894,378	930,271	292,755,307	1,068,450	42,344,600	154,542	335,099,907	1,222,992
Total Thru Sept. 1952	345,117,186	.....	3,237,421,604	.....	3,582,538,790	.....	764,035,253	.....	4,346,574,043	.....
Data by Months, 1951-1952:										
1951—										
January	2,366,782	76,348	26,250,782	846,799	28,617,564	923,147	4,188,000	135,097	32,805,564	1,058,244
February	2,197,169	78,470	24,077,051	859,895	26,274,220	938,365	3,828,000	136,714	30,102,220	1,075,079
March	2,617,455	84,434	27,739,647	894,827	30,357,102	979,261	4,379,000	141,258	34,736,102	1,120,519
April	2,691,667	89,722	27,900,413	930,014	30,592,080	1,019,736	4,303,000	143,433	34,895,080	1,163,169
May	2,935,779	94,702	29,101,521	938,759	32,037,300	1,033,461	4,458,000	143,807	36,495,300	1,177,268
June	2,901,479	96,716	28,084,448	936,148	30,985,927	1,032,864	4,293,000	143,100	35,278,927	1,175,964
July	3,098,156	99,941	29,459,174	950,296	32,557,330	1,050,236	4,439,000	143,193	36,996,330	1,193,430
August	3,236,820	104,413	29,522,041	952,324	32,758,861	1,056,737	4,466,000	144,065	37,224,861	1,200,802
September	3,376,009	112,534	29,628,317	987,610	33,004,326	1,100,144	4,438,000	147,933	37,442,326	1,248,077
October	3,498,088	112,841	31,000,644	1,000,021	34,498,732	1,112,862	4,699,000	151,581	39,197,732	1,264,443
November	3,422,930	114,098	29,127,038	970,901	32,549,968	1,084,999	4,665,000	155,500	37,214,968	1,240,499
December	3,645,768	117,605	29,726,661	958,925	33,372,429	1,076,530	4,659,000	150,290	38,031,429	1,226,820
1952—										
January	3,927,125	126,682	29,150,709	940,345	33,077,834	1,067,027	4,816,000	155,355	37,893,834	1,222,382
February	3,692,263	127,319	29,020,207	1,000,697	32,712,470	1,128,016	4,667,000	160,931	37,379,470	1,288,947
March	4,283,934	138,192	31,760,376	1,024,528	36,044,310	1,162,720	5,163,000	166,548	41,207,310	1,329,268
April	4,215,857	140,528	29,513,786	983,793	33,729,643	1,124,321	5,015,000	167,167	38,744,643	1,291,488
May	3,285,000	105,968	22,866,000	737,613	26,151,000	843,581	2,728,000	88,000	28,879,000	931,581
June	4,134,700	137,823	26,854,700	895,157	30,989,400	1,032,980	5,171,000	172,367	36,160,400	1,205,347
July	4,367,850	140,898	26,723,300	862,042	31,091,150	1,002,940	5,057,200	163,136	36,148,350	1,166,076
August	4,758,200	153,490	29,072,800	937,832	33,831,000	1,091,322	4,889,900	157,739	38,720,900	1,249,061
September	5,196,000	173,200	29,932,500	997,750	35,128,500	1,170,950	4,837,500	161,250	39,966,000	1,332,200
Comparisons; 1951-1952:										
1st 9 Months, 1951	25,421,316	93,118	251,763,394	922,210	277,184,710	1,015,328	38,792,000	142,095	315,976,710	1,157,423
1st 9 Months, 1952	37,860,929	138,179	254,894,378	930,271	292,755,307	1,068,450	42,344,600	154,542	335,099,907	1,222,992
Increase	12,439,613	45,061	3,130,984	8,061	15,570,597	53,122	3,552,600	12,447	19,123,197	65,569
Percent Increase	48.9	48.4	1.2	0.9	5.6	5.2	9.2	8.8	6.0	5.7
September, 1951	3,376,009	112,534	29,628,317	987,610	33,004,326	1,100,144	4,438,000	147,933	37,442,326	1,248,077
September, 1952	5,196,000	173,200	29,932,500	997,750	35,128,500	1,170,950	4,837,500	161,250	39,966,000	1,332,200
Increase	1,819,991	60,666	304,183	10,140	2,124,174	70,806	399,500	13,317	2,523,674	84,123
Percent Increase	53.9	53.9	1.0	1.0	6.4	6.4	9.0	9.0	6.7	6.7

* Small production but no record available.

It's

KEROTEST

FLOW LINE VALVES



Here's What Happened!

The above high pressure gas well in western Pennsylvania was equipped with a 10,000 p.s.i. test KEROTEST cross type master valve and matching Kerotest Flow Line Valves. The well was shot and cleaned through these valves and the well closed off at over 4000 pounds pressure without a leak. A water seal poured on the top valve showed not a bubble! This well is flowing 50,000,000 cu. ft. of gas daily with a back pressure of 2300 lbs. sq. in.

Here's why this KEROTEST Flow-Line Valve is justly famous—

It has positive operation—high safety factors.

Long-wearing—hard faced wedges.

Full opening clearway bore.

Safe—extra heavy walls, high tensile bolting, extra deep stuffing box.

KEROTEST MANUFACTURING COMPANY
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New York Chicago Charleston, W. Va. Tulsa Odessa Houston
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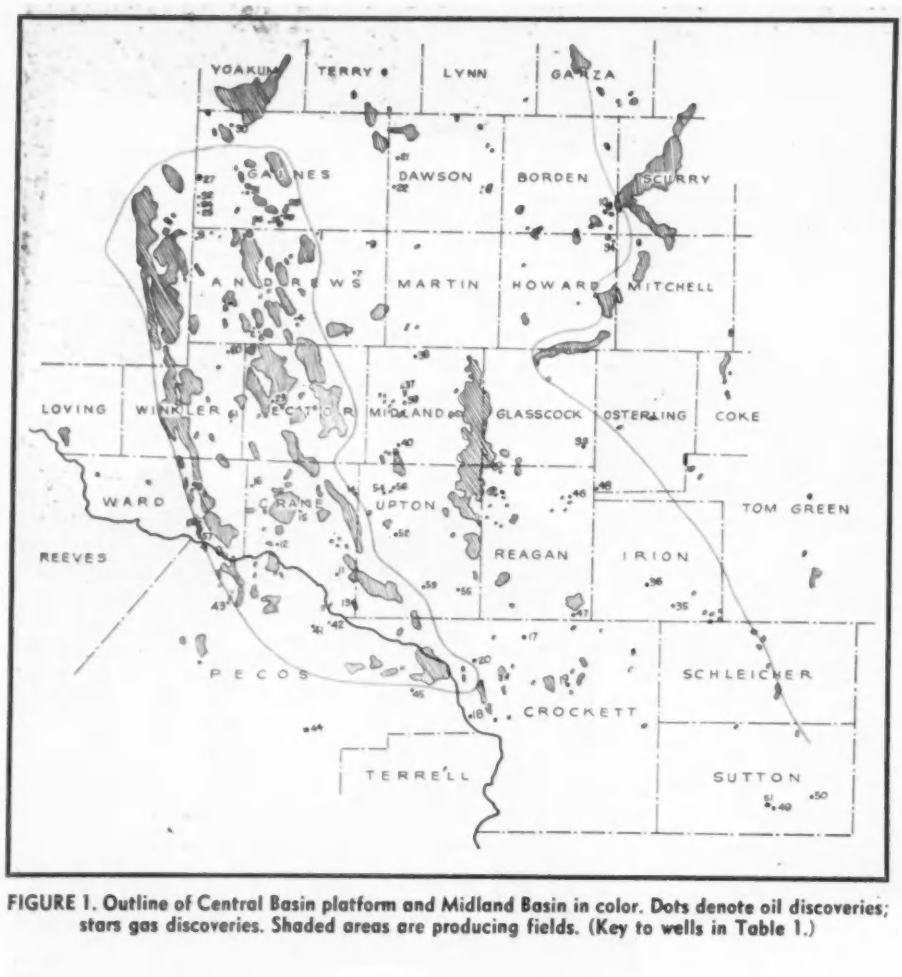

FIGURE 1. Outline of Central Basin platform and Midland Basin in color. Dots denote oil discoveries; stars gas discoveries. Shaded areas are producing fields. (Key to wells in Table 1.)

Exploration Activity Continues High in the Permian Basin

Stepped-up program accounts for 61 oil and gas discoveries in the past year.

By HAWARD L. FISHER
University Lands, Midland, Texas

DURING the past year there has been considerable activity in the Central Basin Platform and Midland Basin regions of the Permian Basin of West Texas.

The more prolific production, as a general rule, was obtained from pre-Pennsylvanian sediments. However, Permian and Pennsylvanian discoveries, although not of large potentials, have contributed substantially to the reserves of the area.

The new field discoveries of September 1951 through August 1952 are listed in Table I, and their locations are shown on the map of oil and gas fields (Figure 1).

Permian Discoveries

Permian discoveries were numerous on the basin platform. New production was found in the San Andres, Clearfork, and Wolfcamp formations. The Magnolia 1 Peay (Figure 1, No. 1), Andrews County, was an outstanding discovery from the Wolfcamp. This well has been responsible for an active search along the entire eastern margin of the platform for production in the transition zone of the Wolfcamp. Other notable Permian discoveries of the northern portion of the platform were, Penrose 1 Littman (Figure 1, No. 3), Westlund 1 Flanagan (Figure 1, No. 26), and Black 3-A Jones (Figure 1, No. 27) of Andrews and Gaines counties. While in the southern part of the platform shallow Permian discoveries in the Yates and Clearfork formations led to increased activity. Clearfork production was found in the Girvin area of Pecos County in the Krasner Trustees 1 Walker (Figure 1, No. 41), and Brown and Thorp 1 White-Gulf (Figure 1, No. 42). Yates pays were discovered in Ward County the Leaman et al 1 Cary (Figure 1, No. 57) and French 4 Moody (Figure 1, No. 58) in the South Ware area.

Notable Permian discoveries in the basin, exclusive of the Spraberry and with two exceptions, were Wolfcamp age. The exceptions were the Seaboard et al 1 Bishop (Figure 1, No. 33) in Glasscock County which produced from a limestone of Leonard age, and the Magnolia 6 Murphy (Figure 1, No. 10) which was a Clearfork discovery in the Von Roeder field in Borden County.

Production Scattered

The Wolfcamp discoveries were, in the main, associated with pre-Pennsylvanian structures, and production was found in widely separated areas of the basin as follows: Texas 1 Fraser (Figure 1, No. 39) in Midland County, Greenbrier 1 Windham (Figure 1, No. 52) and Sinclair 126-1 University (Figure 1, No. 55) in Upton County, and Atlantic 1 Sugg (Figure 1, No. 46) in Reagan County. Also Wolfcamp reef production was found in Dawson County with the completion of the El Tee 96-1 Bailey (Figure 1, No. 21).

During the past year the Spraberry trend has undergone a vast amount of adverse criticism. Many operators are dubious of the economic aspect of this reservoir. However, with the installation of gasoline plants, the advocation of 80 acre spacing, and depending upon the degree of success of a proposed pilot water flood project, there may be considerable change in the future economic picture.

With all this criticism, the Spraberry trend remains the most active

area in the Midland basin with some 80 wells now drilling. During the year the Spraberry trend, for all practical purposes, has become one continuous producing area extending from northeastern Midland County, south to east central Upton County. The length of this area is some 60 miles and varies in width from 10 to 15 miles in the north to 25 to 30 miles in the south. The eastward spread of the Spraberry trend across north central Reagan County and the Honolulu 1-A Sugg (Figure 1, No. 48) in southwestern Sterling County, the most easterly discovery of Spraberry production in the basin, were the highlights of development for the year.

There is no doubt that the Spraberry will continue to cause much comment and speculation, and will tax the ingenuity of the industry in the coming year.

Pennsylvanian discoveries in the Midland Basin were mainly of nonreef type in structure with a trend developing along the western side of the basin. In this trend several discoveries were completed from Pennsylvanian limestone and sand buildups adjacent to the platform. The trend was established in Upton County with the completion of the Gulf 1-H McElroy Ranch, and during the year development has con-

TABLE 1

Summary of Oil and Gas Discoveries in Permian Basin of West Texas During Past Year

	OPERATOR	WELL NAME	County	Completion Date	Total Depth	Production Depth	Initial Production	Gravity	Producing Unit	FIELD NAME
1	Magnolia	Peay 1	Andrews	9- 1-51	14085	9227	F 375 BOPD	39.2	Wolfcamp	Nolley
2	Phillips	University DD-1	Andrews	12-17-51	8350	8230	F 1465 BOPD	42.2	Devonian	Blk. 11 (Dev.)
3	Penrose	Littman 1	Andrews	2-15-52	4354	4313	P 45 Bot. 5 DWPD	32.8	San Andres	Littman
4	Gulf	University NNN-1	Andrews	2-23-52	12628	12519	F 1015 BOPD	49.1	Ellenburger	Triple-N
5	Phillips	University EE-1	Andrews	4-29-52	11065	10884	F 1498 BOPD	43.9	Ellenburger	Blk. 12 (Elln.)*
6	Kerr-McGee	University 1-C	Andrews	4-19-52	9200	6430	F 78 BOPD	39.3	Clearfork	Martin (Clearfork)*
7	Magnolia	University 36994-1	Andrews	5-20-52	13918	13840	F 556 BOPD	44.7	Ellenburger	Magutex
8	Jackson et al	Lineberry 1	Andrews	6-25-52	4715	4589	P 106 Bot. 27 BWPD	31.1	San Andres	.....
9	Texas	University Z-1	Andrews	8-25-52	13725	12530	F 377 BOPD	43.9	Devonian	Blk. 6 (Dev.)
10	Magnolia	Murphy 6	Borden	2-27-52	4343	4291	P 161 BOPD	24.3	Clearfork	Von Roeder*
11	Placid et al	Eppenauer 1	Crane	11-27-51	5395	5161	P 40 BOPD	39.8	Devonian	Eppenauer*
12	Ashmun and Hillard	Jones et al 1	Crane	1-26-52	4124	4090	F 172 BOPD	35.4	Tubb	South "Y" Tubb
13	Texas	Hobbs 1-C	Crane	4-19-52	5502	2960	F 139 BOPD	41.3	Glorieta	Crossett*
14	Hamon	University A-1	Crane	5-13-52	9510	8357	F 97 Bot. 145 BWPD	44.7	Cisco	Dune East
15	Magnolia	Lea 18	Crane	5- 4-52	7608	7590	P 52 BOPD	32.5	Pennsylvanian	Lea
16	Shell	Edwards 2	Crane	7-18-52	7774	4840	P 43 Bot. 43 BWPD	36.4	Tubb	Unnamed
17	Continental	Powell 1-E	Crockett	9-22-51	8288	8088	F 288 BOPD	40.7	Strawn	World*
18	Engle et al	Halff 1	Crockett	11-15-51	1820	1697	P 33 BOPD	32.0	Queen	Unnamed
19	Lion	Shannon 1	Crockett	6- 2-52	7708	7380	F 193 BOPD	38.4	Ellenburger	Wyatt-Elln
20	Deep Rock	Shannon 1	Crockett	7- 2-52	6461	5830	P 136 BOPD	34.0	Cisco	Noelke-5800
21	El Tee	Briley 96-1	Dawson	9-20-51	8640	8575	F 734 BOPD	40.1	Wolfcamp	Mungerville
22	Greenbrier et al	Lindsey 1	Dawson	10-31-51	10972	10957	F 403 BOPD	45.2	Strawn	Lindsey
23	Phillips	TXL TT-1	Ector	4-28-52	5512	4380	F 41 BOPD	37.1	San Andres	Goldsmith*
24	Union	Weltner 2	Gaines	9- 1-51	7144	7108	F 99 BOPD	46.2	Clearfork	Unnamed
25	Hitchcock et al	Dunbar 1	Gaines	11-21-51	4328	4305	F 15 BOPD	31.0	San Andres	Tex-Mex.
26	Westlund	Flanagan 1	Gaines	12-20-51	7313	6354	P 231 BOPD	36.0	Clearfork	Westlund
27	Black	Jones 3-A	Gaines	12- 8-51	4459	4418	F 186 BOPD	30.2	San Andres	Hobbs East*
28	Fuller	Wharton 1	Gaines	1-11-52	6000	4720	P 124 BOPD	32.0	San Andres	Robertson*
29	Cactus	Knight 1	Gaines	3-26-52	6500	5965	P 134 BOPD	32.0	Glorieta	Harris*
30	Texas	Jones 1	Gaines	4-19-52	7900	7390	F 56 BOPD	33.0	Tubb	Unnamed
31	Aurora	Doss 1	Gaines	6- 5-52	9883	9678	P 209 Bot. 10 BWPD	33.0	Devonian	Jenkins-North (Dev.)
32	Midwestern	Ford 1	Gaines	6-14-52	4515	4495	P 6 BOPD	32.0	San Andres	Unnamed
33	Seaboard et al	Bishop 1	Glasscock	7-17-52	6211	6130	F 413 BOPD	....	Leonard	Unnamed
34	Smith	Boyd 1	Howard	10-18-51	7723	7650	F 215 BOPD	43.9	Strawn	East Vincent
35	Moore	Noelke 1	Irion	10- 4-51	7838	7819	F 177 BOPD	44.0	Ellenburger	Kingsely (Elln)
36	Atlantic	Noelke 1-B	Irion	1- 7-52	8380	7413	F 22 BOPD	40.1	Strawn	Monte
37	Texas	Scharbaver D-3	Midland	9-27-51	10722	10658	F 384 BOPD	43.3	Bend	Hi Lonesome*
38	Blackwood and Nichols	Hoffercamp 1	Midland	10-23-51	11316	11140	F 201 BOPD	46.0	Bend	Hoffercamp
39	Texas	Fraser, I-1	Midland	12-31-51	9773	9684	F 156 BOPD	41.0	Wolfcamp	Hi Lonesome*
40	Superior	Windham 4-16	Midland	6-26-52	13245	12353	F 153 BOPD	48.0	Devonian	Pegasus*
41	Krasner Trustees	Walker 1	Pecos	9- 4-51	3139	3139	F 53 Bot. 120 BWPD	39.2	Clearfork	Krasner
42	Brown and Thorp	White-Gulf 1	Pecos	10-24-51	3051	3040	F 194 BOPD	38.6	Clearfork	Brown-Thorp
43	Henderson	Hines 1	Pecos	12-16-51	2235	2040	P 17 BOPD	26.2	Yates	Henderson
44	Phillips	Glenna 1	Pecos	.....	....	....	.....	....	.....	Unnamed
45	Standard of Texas	Owen A-1	Pecos	8-14-52	9990	9705	P 106 Bot. 5 BWPD	38.2	Ellenburger	Unnamed
46	Atlantic	Sugg 1	Reagan	9-11-51	10285	8095	F 103 BOPD	45.1	Wolfcamp	Seven-D
47	Atlantic	University 48C-1	Reagan	6-26-52	9507	9060	F 336 BOPD	41.0	Ellenburger	Unnamed
48	Honolulu	Sugg A-1	Sterling	12-15-51	5151	5130	F 349 BOPD	40.0	Spraberry	Weddell
49	Shell	Miers 3	Sutton	10- 3-51	5009	4149	F 13,000 MCFPD	....	Strawn	Miers
50	Pure	Allison 1	Sutton	12-26-51	5165	5120	F 308 BOPD	32.8	Strawn	Unnamed
51	Phillips	Libb A-1	Sutton	7-18-52	5489	3976	F 13,000 MCFPD	....	Strawn	Miers
52	Greenbrier et al	Windham 1	Upton	4- 2-52	13152	9038	F 450 BOPD	42.0	Wolfcamp	Rancho
53	Bourg and Clark	University A-2	Upton	5-22-52	11260	8570	F 250 BOPD	40.6	Strawn	Bourg-Clark
54	Sinclair	TXL-1	Upton	6- 5-52	11915	10490	P 55 BOPD	43.2	Strawn	Unnamed*
55	Sinclair	University 126-1	Upton	6-10-52	11748	9575	F 476 Bot. 75 BWPD	41.2	Wolfcamp	Blk 4.
56	Magnolia	TXL P-1	Upton	8-16-52	13187	13127	F 290 BOPD	53.5	Ellenburger	Unnamed
57	Leaman et al	Carey 1	Ward	11-18-51	2587	2586	F 245 BOPD	27.9	Yates	Leaman*
58	French	Moody 4	Ward	3-19-52	2685	2674	F 110 BOPD	32.4	Yates	French-Ward*
59	Texas Gulf	University F & H-1	Ward	4- 7-52	2920	2640	F 35 BOPD	27.8	Yates	South Wickett
60	Humble	Evans 2-C	Winkler	4-19-52	8923	8810	P 8 BOPD	40.2	Mississippian	Bar G
61	Stanolind	Wight A-1	Winkler	7-10-52	11612	11510	P 28 Bot. 80 BWPD	38.0	Ellenburger	Unnamed

NOTE: * Indicates new pay horizon in a previously established producing area.

tinued with three discoveries: Hamon 1-A University (Figure 1, No. 14), Crane County, Bourg-Clark 2-A University (Figure 1, No. 53) in Upton County, and Deep Rock 1 Shannon (Figure 1, No. 20) in Crockett County.

Pennsylvanian reef discoveries in Sutton County, of both oil and gas were of interest as the southernmost reef production in the basin. The Pure 1 Allison (Figure 1, No. 50) is the first and only oil producer from the Strawn age reef, and reef gas production was established by the Shell 3 Miers (Figure 1, No. 49). In the Miers area the Phillips 1 Libb (Figure 1, No. 51) was completed as a good gas producer, but production was found in a Pennsylvanian sand just above the reef horizon of the Shell well.

Additional lower Pennsylvanian limestone discoveries of the basin were, the Greenbrier 1 Lindsey (Figure 1, No. 22), Dawson County, and step-out drilling in the northern part of Sweetie Peck and Pegasus fields of Midland seems to indicate a linking of Pennsylvanian production of those areas.

A Mississippian discovery in Winkler County, the Humble 2-C Evans (Figure 1, No. 60), although the initial production was very small, was of interest as the only Mississippian production on the Central Basin platform.

Devonian Discoveries

Increased wildcatting in search for new Devonian production maintained steady progress for the year. The discoveries, although few in number, have had very good potentials and continued to keep the Devonian in the limelight as a potential prolific producer.

The platform discovery of note was the Phillips 1-DD University (Figure 1, No. 2) in central Andrews County; production is from folded and truncated Devonian sediments.

In the northern basin Devonian production was extended westward into eastern Andrews County with the completion of the Texas 1-Z University (Figure 1, No. 9). South of this Texas Company discovery, both the Phillips 1-CC University (a presently drilling Ellenburger test) and Magnolia 1-36994 University (a completed Ellenburger producer) have had good flowing tests from the Devonian section. The Devonian will no doubt be a producing horizon in this area in the near future.

It is noteworthy that after many good Devonian shows in the Pegasus area of Midland County, the Superior 4-16 Windham (Figure 1, No. 40), recently completed, became the first producer from this horizon in that field.

Ellenburger Production

Prolific Ellenburger production was found both on the platform and in the basin during the past year.

The notable platform discoveries were the Phillips 1-EE University (Figure 1, No. 5) on the west side of the Block 12 field of north-central Andrews County, where the deepest previous pay was from the Devonian, and the Gulf 1-NNN University (Figure 1, No. 4), southern Andrews County, near the eastern edge of the platform approximately six miles east of known Ellenburger production.

In the basin discoveries were made in Andrews, Crockett and Reagan counties. The Magnolia 1-36994 University (Figure 1, No. 7) was the first basin Ellenburger production in Andrews County and the most prolific basin discovery of the year. The Lion 1 Shannon (Figure 1, No. 19) between the Todd and Elkhorn fields continued the Ellenburger activity in Crockett County. In Reagan County the Atlantic 1-48C University (Figure 1, No. 47) found what may prove to be a new Ellenburger pool south of present production in the Barnhart area.

The Wilshire and Elkhorn pools, outstanding examples of deep development for the year, progressed from single discovery wells to fields of major importance, and to date their production limits have not been completely defined. The Magnolia 1-P TXL (Figure 1, No. 56), a recently completed producer one and one-half miles north of the one well Sinclair Ellenburger field of Upton County, revived interest in this semi-dormant area.

In the Sheffield channel area of southern Pecos County there was significant wildcat Ellenburger development. The Phillips 1 Glenna (Figure 1, No. 44) was completed as a prolific gas well and the Standard of Texas 1-A Owens (Figure 1, No. 45) produced the first oil from the Ellenburger in this province. These two discoveries should place the Sheffield channel region in the spotlight as a potential petroleum province not to be overlooked in the coming years.

Plenty of Maps

Accompanying this issue is an insert map showing oil, gas and condensate fields and pipe lines in the Permian Basin area of West Texas and New Mexico. Additional copies of the map may be purchased at $1 each by writing to the Circulation Department, WORLD OIL, Post Office Box 2608, Houston 1, Texas.

Permian Basin Output Up

■ CONTINUED FROM PAGE 102

be added to the current actual output of over 1,300,000 barrels daily, the basin's output would rise to almost 2 million barrels per day.

In the decade, 1943-1952, covering the war and postwar years, Permian Basin production showed a four-fold increase to 1,300,000 barrels daily from 300,000 a day in 1942. In the preceding 15 years, 1928-1942, output averaged about 300,000 barrels daily and was predominantly sour crude from shallow Permian formations. Previously, in the eight years, 1920-1927, Permian Basin production had been comparatively small, although that period brought some important discoveries on which subsequent large production was based. Earliest production of the Basin was established in Mitchell County, West Texas, through completion of oil wells in October, 1920, and April, 1921, in the Westbrook field. However, the first sustained prolific production in the Permian Basin was in the Big Lake (shallow) field, Reagan County, Texas, discovered May 28, 1923, by a well completed in the San Andres lime (Permian) at about 3000 feet.

Permian Basin Compared with Other Regions of U. S. in Crude Oil Production

(Daily Average Production in Week Ended September 6, 1952)

REGION	Barrels Daily
Mid-Continent (Tex. Dists. 1, 5, 6, 7-B, 9, 10; N. La.-Ark.; Okla.-Kans.-Mo.; E. Neb.)	1,890,800
Gulf Coast (Tex. Dists. 2, 3, 4; S. La.; Miss.; Ala.; Fla.)	1,594,350
Permian Basin (Tex. Dists. 7-C, 8; S.E. New Mex.	1,320,600
California	983,600
Rky. Mts. (Colo., Utah, N.W. New Mex., W. Neb., Wyo., Mont., N. Dak.)	324,500
Middle West (Ill., Ind., Ky., W. & Cent. Ohio, Mich., Tenn.)	277,300
Appalachian (N.Y., Pa., Va., W. Va., E. Ohio)	50,400
Total, United States	6,441,550

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New Mexico Is Still Booming

- **Wildcat success significant.**
- **25 new pools discovered.**
- **Deeper drilling is paying off.**
- **1952 output up 5 million barrels.**

SOUTHEASTERN New Mexico continued to experience significant developments during the past year year when a total of 462 oil and gas wells were completed in Lea County. Of this number, 292 were below 5000 feet which indicates deeper drilling is finding oil.

Pre-Permian tests hold the spotlight in the northern part of Lea County.

During the first seven months of 1952, 19.0 percent of Southeastern New Mexico wildcats were successful. This compares to 15.2 percent for Texas and 13.2 percent for the entire United States.

Twenty-five new pools were discovered during the year as compared to 15 in 1951. There are 144 wells being drilled in the four-county area of Southeastern New Mexico as compared to 140 at this time last year.

Roosevelt County had one discovery; the only producing well drilled in the County during the past year, while 11 wildcats were unsuccessful.

Only one development oil well was completed in Chaves County, but 16 wildcats failed to find production. Currently nine wells are drilling.

Ellenburger tests below 13,000 feet highpoint Eddy County's activity. Deep drill stem tests are favorable and currently 29 wells are being drilled.

New discoveries and development are as follows:

Lea County

New Mexico's Lea County continues to set state-wide pace for drilling and discoveries. Drilling below 5000 feet is accounting for 60 percent of the county's activities. Pre-Permian tests are centered in northern Lea County. The county's fiscal year record: 34 discoveries and 462 oil and gas wells.

Saunders Area. The Texas Company completed State AT 1 in the Wolfcamp as an extension to the North Saunders pool. The well was drilled to a total depth of 9994 feet and plugged back to 9954 feet. On initial potential the well pumped 36 barrels of oil per day.

Lovington Area. The deeper horizons have received much play in this general area. The rewards of this deep drilling have been no surprise to geologists who have predicted deeper pay for several years.

One deep well, Tidewater's Monteith 1 in 20-16s-37e, flowed 754 barrels of oil per day from the Pennsylvania. The total depth was 11,925 feet and was completed at a plugged back depth of 11,368 feet. This company found the Abo productive in their Meyer 1 located in 33-16s-37e, when this well pumped 59 barrels of oil per day from a plugged back depth of 8365 feet.

New Abo pay was found in East Lovington in Skelly Oil Company's State "O" 9, in 31-16s-37e. The well flowed 881 barrels of oil per day through a ¾-inch choke at a plugged back depth of 8440 feet.

In 12-17s-36e a Paddock discovery was made at 6363 feet.

Tulk Area. Three new fields were discovered in this general vicinity when wells were projected below 9800 feet. In 16s-34e, a Wolfcamp discovery was found by The Texas Company at 9802 feet. This well flowed 1418 barrels of oil per day on a ½-inch choke.

In this same area Phillips Petroleum Company completed Pello State "B" 1 as a Wolfcamp producer. It was drilled to a total depth of 10,294 feet and plugged back to 9624 feet and completed as a 178-barrel per day flowing well.

Another Wolfcamp well by Phillips, in 2-15s-32e, pumped 47 barrels of oil per day from a plugged back depth of 9547 feet. Initially this well was drilled to 10,335 feet.

Baish-Maljamar Area. In 22-17s-32e, Buffalo Oil Company, successfully completed a Devonian producer at 13,573 feet for an initial flowing potential of 578 barrels of oil per day.

Caprock Area. In the northern Caprock area, about four miles north of the Moore field, a Pennsylvanian discovery was recorded by Jackson et al, in 27-10s-32e. The total depth of 10,189 feet was plugged back to 8451 feet where the well was completed flowing 240 barrels of oil per day through a 16/64-inch choke.

A well in the Moore field in 25-11s-32e was completed for 2904 barrels of oil per day flowing from the Devonian at 10,471 feet.

A few miles south near East Caprock, a new pool was discovered by Amerada Petroleum Corporation's State ECA 1, which was completed in the Devonian for an initial potential of 550 barrels of oil per day at 11,314 feet.

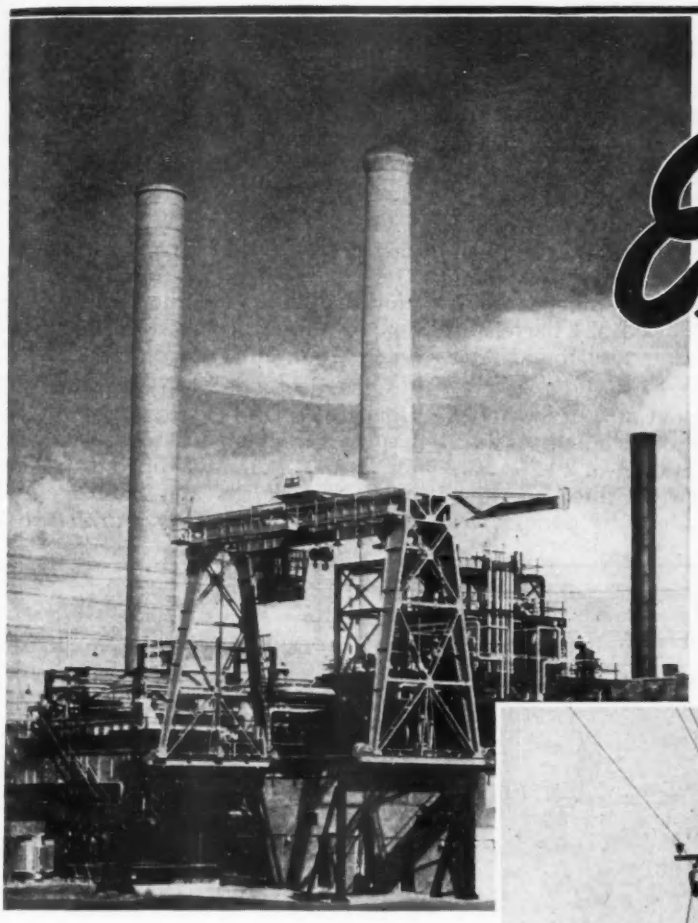
King Area. A Permo-Penn. discovery was made in 13s-37e by Forest Oil Corporation. This well was drilled to 13,145 feet and completed flowing 385 barrels from a plugged back depth of 10,140 feet.

Brunson Area. The general area around North Brunson received its share of activity when wells were completed in the Seven Rivers, Grayburg-San Andres, Abo and Blinebry formations.

Four miles northeast of the North Brunson pool, in 32-20s-39e, a Drilling and Exploration Company well pumped 33 barrels of 31-gravity oil from the Grayburg-San Andres. Production was from perforations at 4178-4330 feet and a total depth of 4360 feet was reported.

Another San Andres discovery was made by Fullerton Oil Company, three miles east of North Brunson in 9-21s-38e. This well pumped 41 barrels of oil per day at 4382 feet.

A Blinebry well was also found in this same general area: 1-21s-38e.



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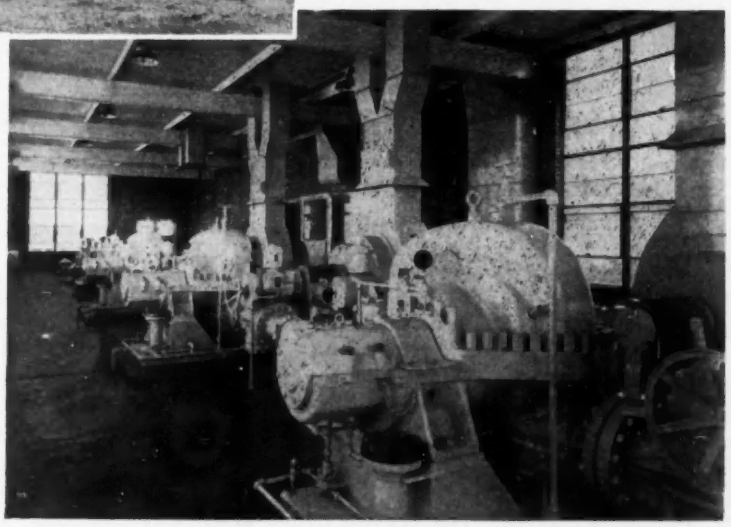


TEXAS ELECTRIC SERVICE COMPANY

Originally drilled to 8613 feet the well was completed flowing 135 barrels of oil per day from a plugged back depth of 6025 feet.

Cooper-Jal-Langlie Mattix-West Dollarhide Area. This area continued to have significant discoveries. Perhaps no well drilled during 1951 was as outstanding as the Ellenburger discovery of Skelly's Mexico "J"-1, which flowed 583 barrels of oil per day from 10,245 feet. This well clearly indicated the presence of Clearfork-Drinkard pay horizons which were found in the Mexico "K"-1 29-24s-38e. Skelly also opened a Fusselman-Silurian discovery in 32-24s-38e, when the well which was plugged back from 10,320 feet to 8790 feet, flowed 1996 barrels of oil per day.

The Texas Company's Penny 1, in 5-25s-38e, opened the Devonian in this area when it was drilled to 9405 feet. Upon being plugged back to 8413 feet it flowed 611 barrels of oil per day.

Skelly's well in 6-25s-38e, opened the Queen sand in West Dollarhide field when it pumped 82 barrels of oil per day from a plugged back depth of 3836 feet.

Towsend Area. The deepest drilling in the state was completed in this area by Humble Oil and Refining Company when a gas well was completed in the Pennsylvanian at a plugged back depth of 13,250 feet, after having gone to 14,763 feet in 1-16s-38e.

Wilshire Oil Company completed an oil and distillate discovery in 4-16s-35e. This well, producing from the Wolfcamp had a total depth of 13,803 feet. The well flowed 263 barrels of oil per day and 257 barrels distillate from a plugged back depth of 11,000 feet.

East Hobbs Area. Of particular interest to Permian Basin operators was the Aurora Gasoline Company's Davis "O"-1 in 29-18s-39e. The well blew out of control for several days at total depth 4469, but was completed in the San Andres for 720 barrels of oil per day. This well led to the extension of the field into Gaines County, Texas.

Two other discoveries finding production from the Blinebry and Drinkard were located in 29-18s-39e and 4-19s-38e respectively.

Echols Area. The Devonian horizon produced two deep discoveries in this general vicinity. The Texas Company's State AW-1 flowed 899 barrels of oil per day from a plugged back depth of 12092 feet. This well located in 21-10s-37e was drilled to a total depth of 12,140 feet.

Another Texas Company well, the State AR-1 in 2-11s-37e, flowed 319 barrels of oil per day from 11,580 feet.

Eunice-Monument Area. Continental Oil Company found Abo production in 21-21s-37e, after the well which had been drilled to a total depth of 8370 feet was plugged back to 7340 feet. It flowed 524 barrels of oil per day. Sinclair also found Abo production in 23-21s-37e.

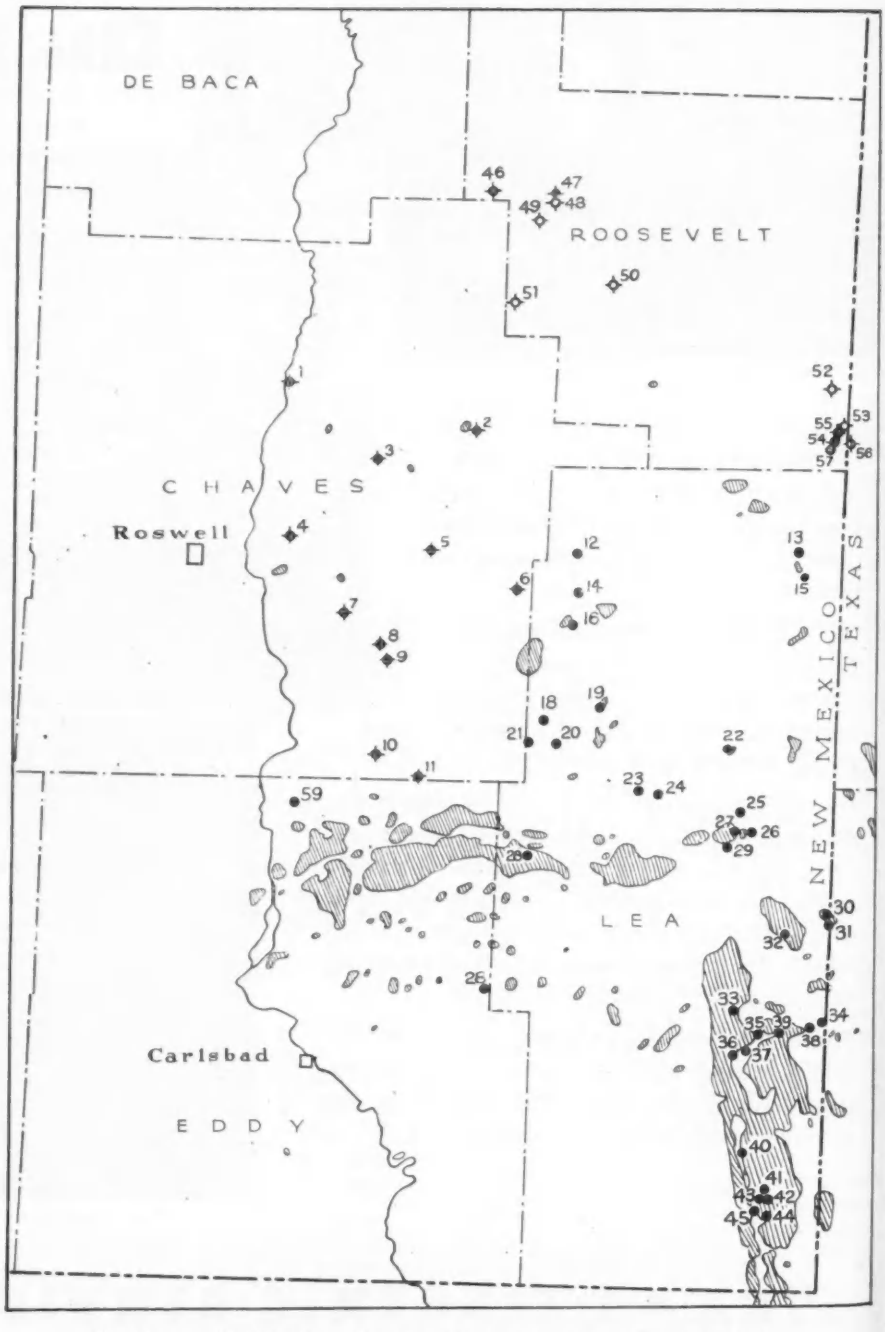
In the Monument area, a few miles north of the Wilson field, the Wilson Oil Company's State 4 in 29-20s-36e, resulted in a new oil discovery in a new gas area. The well pumped 54 barrels of oil per day from the Seven Rivers at 4201 feet.

Eddy County

Eddy County has four tests in the process of drilling to projected depths below 13,000 to test the Ellenburger.

One of these wells, Richardson and Bess' Cobb-Federal 1, in 23-20s-31e, recovered oil on a drillstem test around 7000 feet in the Cherry Canyon or Bushey Canyon of the Delaware Mountain group.

One deep test, Continental Oil Company's Duffield 1, in 26-16s-27e, has been completed as a gas well with an initial potential of 3.8 million cubic feet of gas and 30 barrels of distillate per day. It was drilled to a



Significant wells drilled in southeastern New Mexico. (Key to map in Table 1.)

total depth of 10,188 feet and plugged back to 8766 to the Pennsylvanian.

At the present time 29 wells are being drilled in Eddy County.

Chaves County

Deeper drilling featured the year's activity in Chaves County as seven wildcats were drilled below 7000 feet. Sixteen wildcats were drilled in the past year. One well in 11s-28e was drilled to 11,066 feet. Another deep test in 15s-29e was drilled to 10,822 feet. Both of these wells were nonproductive.

Three wells were drilled to the Granite. The deepest in 9s-28e was drilled to 7463 feet. A well in 18s-16e was drilled to 3147 feet, while a Sun Oil Company well in 19s-17e encountered granite at 1911 feet.

The only development well for the year was the Keller & Peterson's State A-2 in the Chisum-San Andres Pool in 13-11s-27e. This well was completed in the San Andres for an initial potential of 58 barrels of oil per day on 2-inch choke at 2090 feet.

Currently, nine wells are drilling. This county had less activity than in past years, and the wildcats offered little returns for the capital outlay.

Roosevelt County

As the result of drilling Magnolia Petroleum Company's Brown 1, 6-7s-34e, the appropriately named New Hope Pool became Roosevelt County's first production.

Since that discovery in June, 1951, twelve wells have attempted to find profitable production. Only one of these wells was a discovery. The Austral Oil Exploration Company drilled the discovery well near Bluitt, which flowed 104 barrels of oil per day from the San Andres through perforations 4598 to 4798 feet.

Unsuccessful wildcat activity took place near the town of Claudell, near Elida, and north of Bluitt near the Cochran County line.

1951 Output

During 1951, southeastern New Mexico ran 52,479,289 barrels of oil and 110,809 barrels of distillate to the pipe line for an accumulative of 718,926,753 barrels of oil and 201,637 barrels of distillate.

187,253,025 mcf of casinghead gas and 91,538,985 mcf of dry gas (gas well gas) was produced in Lea County during 1951.

Twelve gasoline plants in Eddy and Lea counties processed a total of 222,808,676 mcf—of which 43,333,-251 mcf was sold to carbon black plants, 136,718,710 mcf to pipe lines and 3,266,482 mcf was used in repressuring. The twelve gasoline plants produced 3,873,877 gallons of gasoline, 1,406,167 barrels of butane and 749,172 barrels of propane.

Five carbon black plants in Lea County used a total of 56,266,801 mcf of gas to produce 112,036,682 pounds of carbon black.

TABLE 1

Detail Description of Wells Shown on Development Map of Southeast New Mexico

CHAVES COUNTY

Map No.	S.T.R.	Company	Lease	Potential	Total Depth	Producing Formation
1	7-7S-27E	Joseph I. O'Neill, Jr.	Lodewick Federal A #1	Dry	2180	.....
2	5-8S-30E	Magnolia Pet. Co.	Burt-Federal #1	Dry	8015	.....
3	31-9S-28E	DeKalb & Magnolia	White Unit #1	Dry	7463	.....
4	21-10S-26E	De Kalb & Lyman	Elliott #1	Dry	1000	.....
5	28-10S-29E	DeKalb & Los Nietos	White X #1	Dry	9135	.....
6	22-11S-31E	Hassie Hunt Trust	Mannery-Elliott #1	Dry	11066	.....
7	12-12S-27E	G. R. Gibson	Humble State #1	Dry	8020	.....
8	35-12S-28E	Malco Refs., Inc.	Waller #1	Dry	8820	.....
9	12-13S-28E	J. D. Hudgens	State B #1	Dry	200	.....
10	14-15S-28E	Malco Refs., Inc.	Oliver-Federal 1	Dry	3522	.....
11	14-15S-29E	McCurdy & McElroy	Key #2	Dry	10822	.....

LEA COUNTY

Map No.	S.T.R.	Company	Lease	Potential	Total Depth	Producing Formation
12	27-10S-32E	Jackson et al	State #1	F 240 BOPD	10,189-PB 8451	Pennsylvanian
13	21-10S-37E	The Texas Co.	State AW #1	F 899 BOPD	12,140-PB 12,092	Devonian
14	25-11S-32E	The Texas Co.	Moore #1	F 2904 BOPD	10,471	Devonian
15	2-11S-37E	The Texas Co.	State AR #1	F 319 BOPD	11,580	Devonian
16	14-12S-32E	Amerada Pet. Corp.	State ECA #1	F 550 BOPD	11,314	Devonian
17	25-13S-37E	Forest Oil Corp.	Lowe #1	F 385 BOPD	13,145-PB 10,140	Permo-Penn.
18	20-14S-32E	Phillips Pet. Co.	Pello St. "B" #1	F 178 BOPD	10,294-PB 9624	Wolfcamp
19	10-14S-33E	The Texas Co.	State AT #1	P 36 BOPD	9,994- PB 9954	Wolfcamp
20	2-15S-32E	Phillips Pet. Co.	Pello St. "A" #1	P 47 BOPD	10,335-PB 9547	Wolfcamp
21	6-15S-32E	The Texas Co.	State AS #1	F 1418 BOPD	9,802	Wolfcamp
22	9-15S-36E	Magnolia Pet. Co.	Black #1	P. & A.	13,763	Devonian
23	1-16S-34E	Humble Oil & Refg.	Elliot #1	4,540 MCF	14,763-PB 13,250	Pennsylvanian
24	4-16S-35E	Wilshire Oil Co.	Townsend #1	F 263 BOPD 257 Bbls. Dist.	13,803-PB 11,000	Wolfcamp
25	20-16S-37E	Tidewater Assoc.	Monteith #1	F 754 BOPD	11,925-PB 11,368	Pennsylvanian
26	33-16S-37E	Tidewater Assoc.	Meyers #1	P 59 BOPD	11,254-PB 8365	Abo
27	31-16S-37E	Skelly Oil Co.	State O #9	F 700 BOPD	8500	Abo
28	22-17S-32E	Buffalo Oil Co.	Baish B #12	F 578 BOPD	13,573	Devonian
29	12-17S-36E	McBee	State A #2	F 204 BOPD	6363	Paddock
30	29-18S-39E	Aurora Gasoline	Davis #1	F 720 BOPD	4465	San Andres
31	29-18S-39E	Aurora Gasoline	Davis #2	P 115 BOPD	6433	Blinebry
32	4-19S-38E	Stanolind Oil & Gas	State A #11X	P 65 BOPD	8160-PB 7020	Drinkard
33	29-20S-36E	Wilson Oil Co.	Charlotte State #4	P 54 BOPD	4201	Seven Rivers
34	32-20S-39E	Drlg. & Expl. Co.	State Q #1	P 33 BOPD	4360	Grayburg-San Andres
35	12-21S-37E	Shell Oil Co.	Chesher #1	F 144 BOPD	7695-PB 7516	Abo
36	21-21S-37E	Continental Oil	Wantz A #1	F 524 BOPD	8370-PB 7340	Abo
37	23-21S-37E	Sinclair Oil & Gas	Barton #1	F 224 BOPD	7787-PB 7716	Abo
38	1-21S-38E	Fullerton Oil Co.	Elliott "L-1" #2	F 135 BOPD	8613-PB 6025	Blinebry
39	9-21S-38E	Fullerton Oil Co.	Elliott "A-1" #4	P 41 BOPD	4382	San Andres
40	34-23S-37E	Amon G. Carter	Hill #1	F 823 BOPD	7484-PB 7345	Devonian
41	29-24S-38E	Skelly Oil Co.	Mexico K #1	F 145 BOPD	9177-PB 6745	Drinkard
42	32-24S-38E	Skelly Oil Co.	Mexico J #1	F 583 BOPD	10,245	Ellenburger
43	32-24S-38E	Skelly Oil Co.	Mexico J #3	F 1996 BOPD	10,320-PB 8790	Fusselman
44	5-25S-38E	The Texas Co.	Penny #1	F 611 BOPD	9405-PB 8413	Devonian
45	6-25S-38E	Skelly Oil Co.	Mexico O #1	P 82 BOPD	6997-PB 3836	Queen

ROOSEVELT COUNTY

Map No.	S.T.R.	Company	Lease	Potential	Total Depth	Producing Formation
46	27-2S-29E	Tidewater Assoc. Oil	Best #1	Dry	7277	.....
47	25-2S-30E	Baker & Taylor Drlg.	Best #1	Dry	3755	.....
48	36-2S-30E	Baker & Taylor Drlg.	State #1	Dry	3335	.....
49	14-3S-30E	Lynn Greer	Vinther #1	Dry	820	.....
50	29-4S-32E	Austral Oil Expl. Co.	Sadler #1	Dry	8154	.....
51	7-5S-30E	Tidewater Assoc. Oil	Boone #1	Dry	8176	.....
52	1-7S-37E	Great Western Drlg.	Bilberry #1	Dry	8113	.....
53	32-7S-38E	P. L. Davis	Nix-State #1	Dry	4841	.....
54	7-8S-38E	Austral Oil Expl. Co.	Yadon #1	Dry	4791	.....
55	7-8S-38E	Sinclair Oil & Gas	Saner-Federal E1	Dry	4857	.....
56	16-8S-38E	Gulf Oil Corp.	State T #1	Dry	4845	.....
57	18-8S-38E	Austral Oil Expl. Co.	McGraim #1	F 104 BOPD	4802	.....

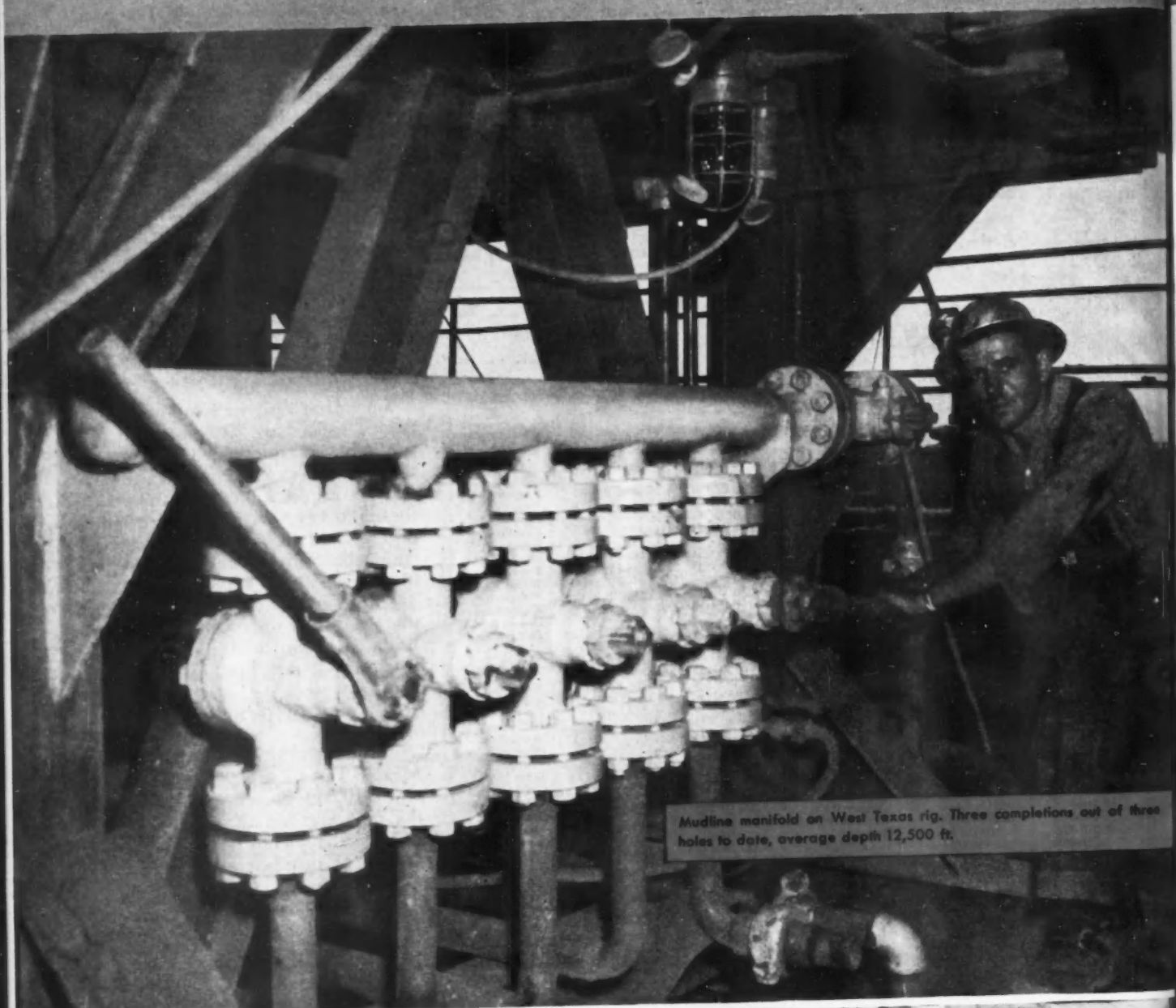
EDDY COUNTY

Map No.	S.T.R.	Company	Lease	Potential	Total Depth	Producing Formation
58	23-20S-31E	Richardson & Bass	Cobb Federal #1	Drlg.	.....	.....
59	21-16S-27E	Continental Oil Co.	Duffield #1	Dry	10,188	.....

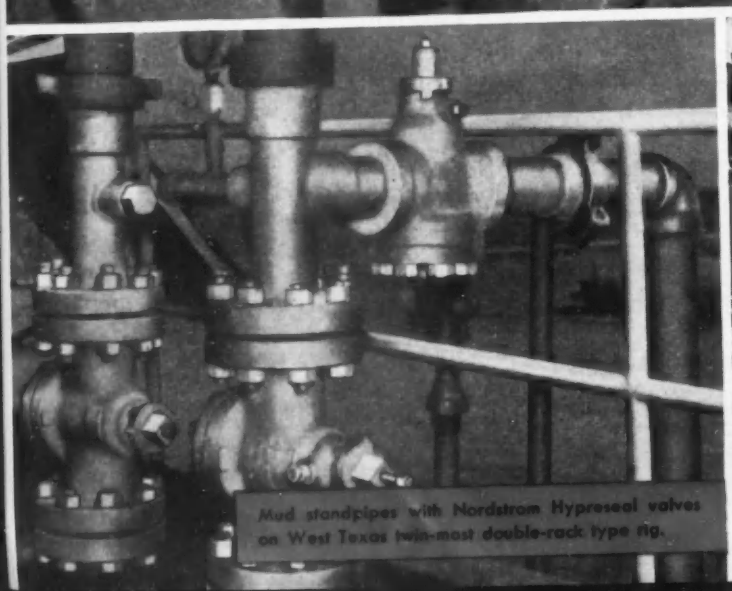
ACKNOWLEDGEMENT

WORLD OIL gratefully acknowledges the material supplied by George H. Hirschfeld, petroleum engineer for the New Mexico Oil and Gas Engineering Committee and R. M. Knoepfel, scout for the Atlantic Refining Company, also president of the National Scouts Association.

10 TIMES LONGER Mud Line



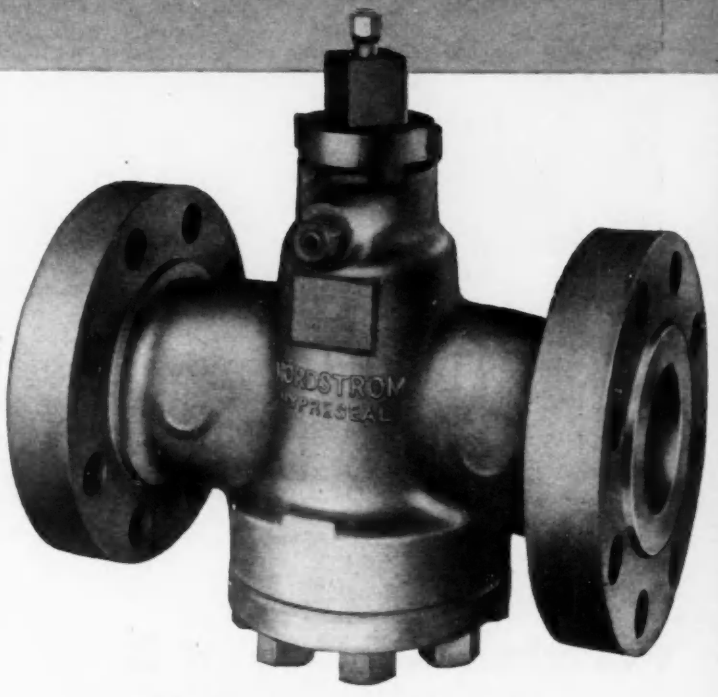
Mudline manifold on West Texas rig. Three completions out of three holes to date, average depth 12,500 ft.



Mud standpipes with Nordstrom Hypreseal valves on West Texas twin-mast double-rack type rig.

Mud pump lines on contract rig in Dickinson field, Texas gulf coast.

Valve Life With Nordstroms



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California Louisiana Kansas Oklahoma Permian Basin

Permian Basin 'Hot Spot' Of U. S. Drilling Activity

Area accounts for 15 percent of all wells and more than 21 percent of footage drilled.

By CECIL W. SMITH
WORLD OIL Staff

THE GREAT Permian Basin, consisting of West Texas and Southeastern New Mexico, continues to be the most active oil province in the U. S. Despite some recent easing in operations along the Spraberry trend, the Basin's current "hot" play, drilling activity continues to lead the way and outdistance all other regions. Texas, in which the greater part of the Permian Basin is located, is the only state that can top the region in drilling statistics.

An increasingly important role in the nation's search for oil and gas is being played in this vast area called Permian Basin. As late as 1949, less than 10 percent of the nation's wells were drilled in this region, and only about 13 percent of all footage was recorded there. Today, almost 15 percent of all U. S. wells are located in this western oil province and more than 21 percent of all footage is being drilled in those wells. Just a comparison of the number of wells drilled is not a true and fair measure of drilling efforts in the Permian Basin. While the number of wells completed is of most importance, the depths to which the tests are taken and the types of formations through which they must go are the best yardsticks of drilling operations.

So far this year, Permian Basin wells have been drilled to almost 6000 feet on the average. That is almost 2000 feet or 45 percent deeper than the U. S. average. The spread in drilling contractor prices in the Basin compared with costs on the Texas Gulf Coast is indicative of the relative difficulties of drilling a well in those two regions. Many considerations enter into drilling costs, and in so vast an area as the Permian Basin there are many varying conditions, but on the average, contractor's bids are from 6 to 7 times as much per foot as they are on the coast. One of the principal reasons being the relative hardness of formations and the time required to penetrate them.

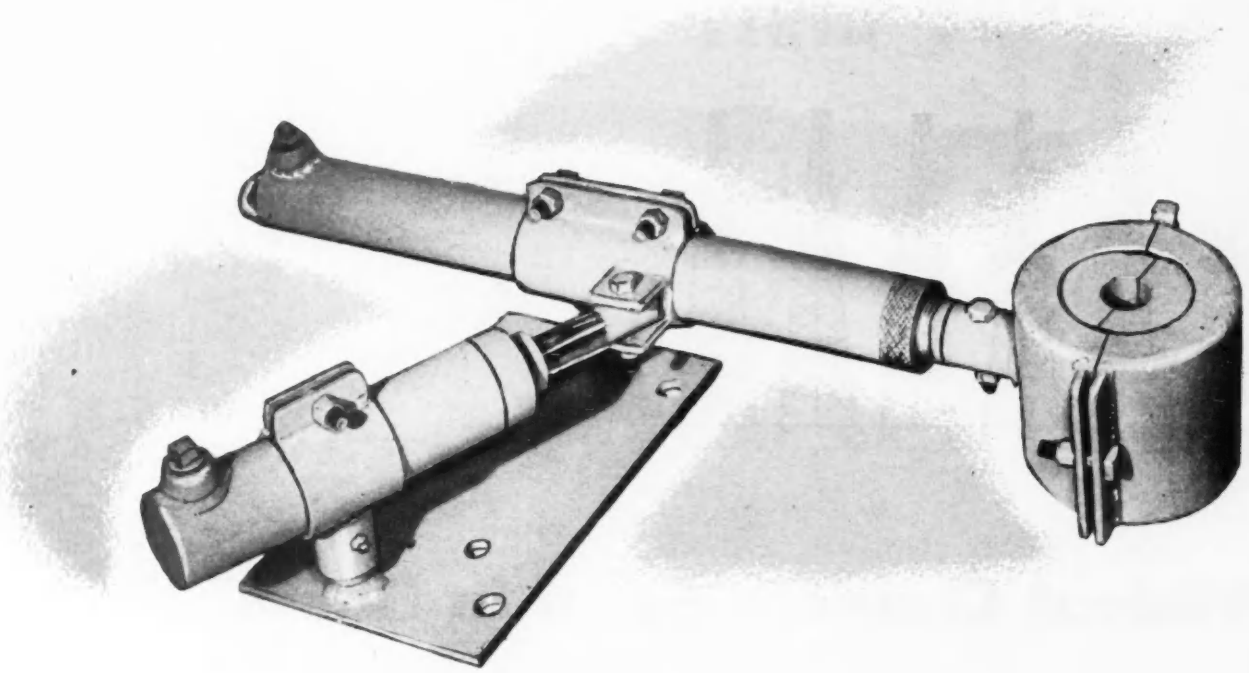
During the first seven months of 1952, new wells completed in the Permian Basin numbered 4015 to account for 14.7 percent of the nation's total. A year earlier, the region had contained 13.4 percent of all new wells. Recently, each year has seen a greater part of the U. S. drilling being done in the Basin.

Drilling in the Basin's Spraberry trend reached a peak in the latter part of 1951 and first part of 1952. Since then drilling operations have been cut back substantially, due mostly to pipe shortages brought by the recent steel mill strike. However, it is highly probable that the Spraberry activity will never regain its previous rates, as now some operators are beginning to consider the Spraberry as a not-too-promising risk.

At present many Spraberry wells are not making their allowables, and pay out appears to be a long range affair. With wells costing something like $125,000 each, the payout process would be quite slow at producing rates of 50 barrels or less a day. However, there remains the fact that Spraberry formations contain an abundance of oil and development on a lesser scale will continue.

	NEW WELLS COMPLETED		FOOTAGE DRILLED		RIGS RUNNING ON JULY 31	
	No.	Percent Of U.S.	Amount	Percent Of U.S.	No.	Percent Of U.S.
TOTAL PERMIAN BASIN: (West Texas and Southeast New Mexico):						
Seven Months, 1952	4,015	14.7	23,784,215	21.2	627	13.4
Seven Months, 1951	3,308	13.4	17,501,217	18.4	733	14.7
Year, 1951	5,923	13.2	32,278,274	18.5	733	14.7
Year, 1950	5,596	12.9	29,369,191	18.4	689	14.6
Year, 1949	3,768	9.6	18,614,504	13.4	505	12.6
WEST TEXAS—(Dist. 7-C and 8):						
Seven Months, 1952	3,539	13.0	20,826,046	18.5	519	11.1
Seven Months, 1951	3,016	12.2	16,010,751	16.9	643	12.9
Year, 1951	5,383	12.0	29,293,100	16.8	643	12.9
Year, 1950	5,054	11.7	26,894,552	16.8	603	12.8
Year, 1949	3,284	8.4	16,417,982	11.8	426	10.6
SOUTHEAST NEW MEXICO:						
Seven Months, 1952	476	1.7	2,958,169	2.7	108	2.3
Seven Months, 1951	292	1.2	1,490,466	1.5	90	1.8
Year, 1951	540	1.2	2,985,174	1.7	90	1.8
Year, 1950	542	1.2	2,474,639	1.6	86	1.8
Year, 1949	484	1.2	2,196,522	1.6	79	2.0

HAVING WIRE LINE TROUBLES?



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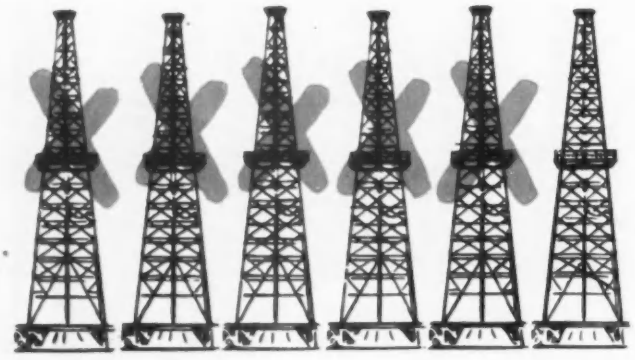
	New Fields Discovered Jan.-July, 1952	Total Wildcats Drilled	Percent Successful	Wildcats Drilled For Each Discovery
Permian Basin	99	622	15.9	6¼
Texas	410	2,694	15.2	6⅔
Kansas	80	588	13.6	7⅛
Oklahoma	59	475	12.4	8
Louisiana	41	237	17.3	5¾
California	22	217	10.1	10
Rest of United States	110	1,313	8.4	12



	New Fields Discovered	Total Wildcats Drilled	Percent Successful	Wildcats Drilled for Each Discovery
TOTAL PERMIAN BASIN (West Texas and S.E. New Mexico)				
1952 (7 Months)	99	622	15.9	6¼
1951	155	898	17.3	5¾
1950	115	700	16.4	6
1949	83	416	20.0	5
West Texas (Districts 7-C and 8)				
1952 (7 Months)	85	547	15.5	6⅓
1951	137	815	16.8	6
1950	99	616	16.1	6¼
1949	68	351	19.4	5
New Mexico				
1952 (7 Months)	14	75	18.7	5⅓
1951	18	83	21.7	4⅔
1950	16	84	19.0	5¼
1949	15	65	23.1	4⅓

Wildcat Chances Good in Basin

West Texas-New Mexico area has yielded 99 new fields out of only 622 wildcat wells drilled in 1952

MATHEMATICALLY, a wildcatter's chances of opening a new oil or gas field are somewhat better in the Permian Basin of West Texas and Southeastern New Mexico than in almost any other region in the U. S. So far in 1952, this great western oil province has yielded 99 new oil and gas fields, and it took the drilling of only 622 wildcat wells to attain this record.

Of course, that is still a lot of expensive dry wells, but in comparison with other areas and the U. S. as a whole, oil and gas hunting in the Permian Basin is pretty good. As could be expected, these fine odds have resulted in unusually high activity, and today the region accounts for more than 11 percent of all U. S. wildcatting. At the present, the Permian Basin is seeing the most active wildcatting program in its oil history.

The 99 new field discovery wells drilled in the Basin during the first seven months of 1952 amounted to 15.9 percent of the 622 wildcat wells completed. That figures to be 1 discovery out of every 6¼ wildcat tries. That tops the U. S. as a whole and almost every other principal drilling area, but even so it represents some decline from the fine records racked up in previous years. The 1951 record was 155 new producing areas from a total of 898 tests. That one was good for a 17.3 percent score or 1 discovery out of 5¾ tries, which was some better than the 1952 record todate.

A somewhat leaner year was experienced in the Basin during 1950, but the going was still quite good. New discovery wells totaling 115 amounted to 16.4 percent of the 700 wildcats completed. One out of six was the score in that period. Percentagewise, the banner period of recent years was 1949, when 83 new oil and gas fields resulted from the drilling of 416 wildcat wells. That year, on the average, it took only five attempts to open a new field.

A comparison of the Permian Basin's 1952 wildcat campaign with operations in other principal regions shows it to be more active, and in almost every case more successful. Of course, Texas, in which most of the Basin lies, continues to be the most active drilling state. And although many more wildcat wells were drilled in the state as a whole, its success percentage was 15.2 as compared with the Basin's 15.9.

Kansas came closest to matching the Permian Basin wildcat for wildcat, but fell short in the results column. Eighty new fields were added to Kansas' list, but it took 588 attempts to accomplish the feat. One find out of 7⅛ tries was the state's score.

Next in line was Oklahoma with 59 new discoveries, or 1 out of 8. The only principal area topping the Permian Basin in wildcatting success ratio was Louisiana. That state boasts of 41 new oil and gas fields discovered this year from 237 wildcat attempts. That figures to be 17.3 prcent successful and puts the state on top with a score of 1 new discovery out of 5¾ efforts.

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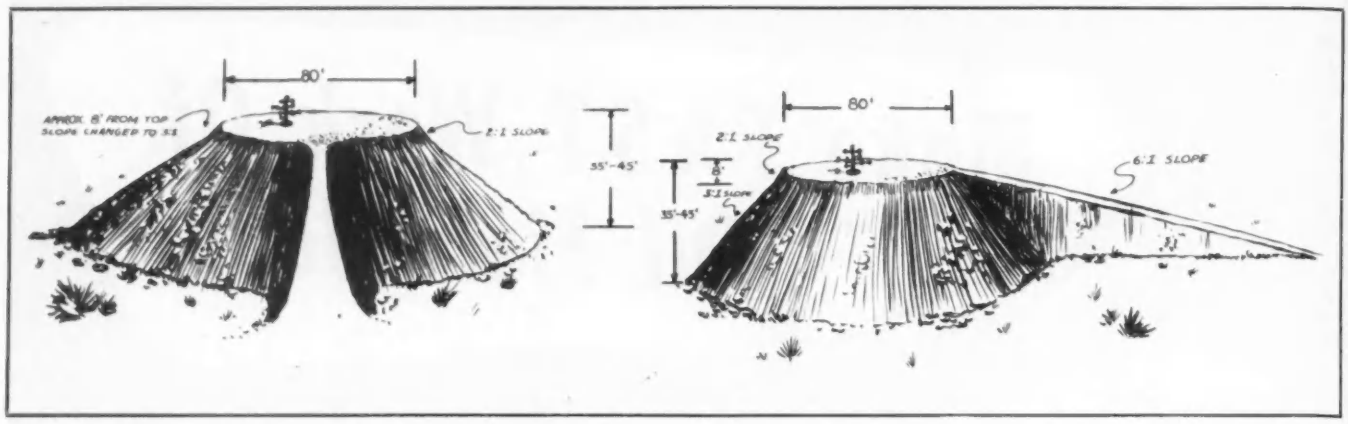

FIGURE 1. Conical type mound constructed around producing wells. An area measuring 80 feet in diameter allows for future maintenance work which may be performed from barges.

Von Roeder extension into Borden County to be submerged by reservoir, resulting in new completion practices in . . .

Marine Operations in West Texas

WHEN the dam on the Colorado River in southeast Borden County, Texas, is filled with water, the south extension of the Von Roeder field will be virtually covered with 35 to 40 feet of water. Problems of drilling and producing the wells located in what is to be Lake Thomas are unique and quite foreign to Permian Basin practices. Not only must producing wells, of which there are 13, be prepared for water sites, but proposed locations must also be prepared prior to filling the area with water.

The Colorado River Municipal Water District was authorized by the State to construct an earthern dam across the Colorado river approximately 11 miles south and 14 miles west of Snyder, Texas, to trap water which will supply Snyder, Big Spring and Odessa via pipe lines. Since the initiation of the lake project, what is believed to be a south extension of the Von Roeder field has been drilled by several companies, including Magnolia Petroleum Company, Shell Oil Company, Phillips Petroleum Company and Skelly Oil Company.

Since several of the wells and proposed locations are on land which will be inundated with water, the CRMWD has constructed earthen mounds in the lake bed and these will be small man-made islands when the lake is filled. The water is to be used as water supply for the three cities and it was necesary to take special precautions against contamination.

In order to complete wells in this elevated position, it is necessary to build the mound and drill wells from the top of the mound. In the case of wells completed before the mound is constructed, the casing and christmas tree must be elevated and the mound filled in around it. Actually both methods are employed, i.e., in one instance the mound is constructed prior to drilling, and in the second case, the mound is made after the wells have been completed.

Earthern Mounds

Two types of earthern mounds are being built. One type resembles the frustum of a cone. This type is constructed around the elevated casing and christmas tree of completed wells. The second type is similar to the frustum of a pyramid and has a rectangular surface on top. This shape surface area was found to be most convenient and the most economical to support a drilling rig for proposed locations. These mounds measure 80 feet by 110 feet at the top, which is a relatively small area in which to operate a drilling rig.

Figure 1 illustrates this type mound for drilling rigs on future locations. It is about 35 to 40 feet in height, with a 3 to 1 slope on the sides up to the expected water level (6 to 8 feet from the top). Here, the slope changes to 2 to 1. Slope of the earthern ramp is about 6 to 1. This type mound contains about 60,000 to 80,000 cubic yards of dirt and costs about $30,000 to build. Construction time is about 30 to 35 days.

Figure 2 is the cone-shaped mound built around wells that have been drilled and in which case the casing and christmas tree are elevated some 35 or 40 feet above the ground level. It is not as large as the proposed

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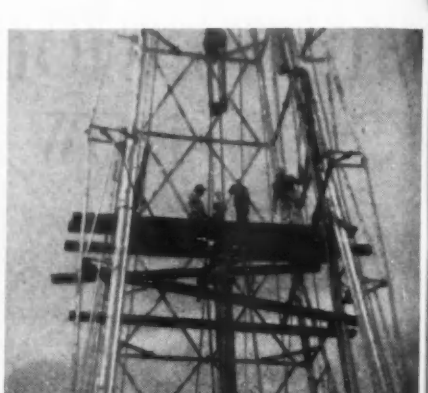
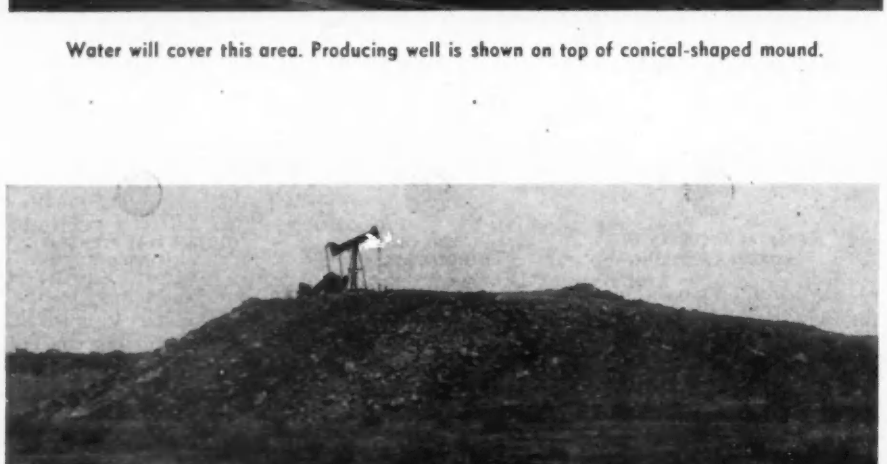
General view of field operations in Colorado River bottom in southeast Borden County. Drilling well in background and completed mound in center.

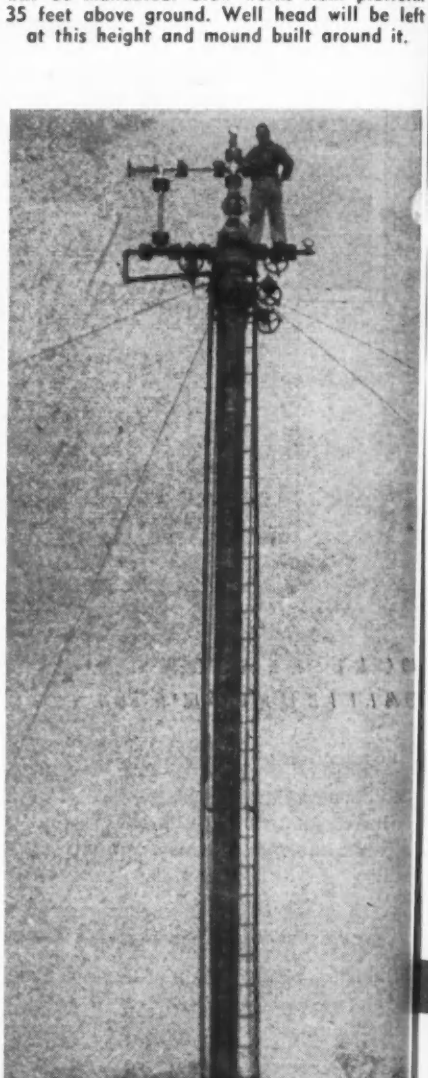


Crewmen complete flowing well in area that will be inundated. Crew works from platform 35 feet above ground. Well head will be left at this height and mound built around it.

Water will cover this area. Producing well is shown on top of conical-shaped mound.



Pumping unit set atop one of smaller mounds. Note ramp at right.



Rig has been moved and pumper is adjusting flow from atop completed well in Colorado River bottom. Mound will be built around casing leaving only christmas tree exposed.

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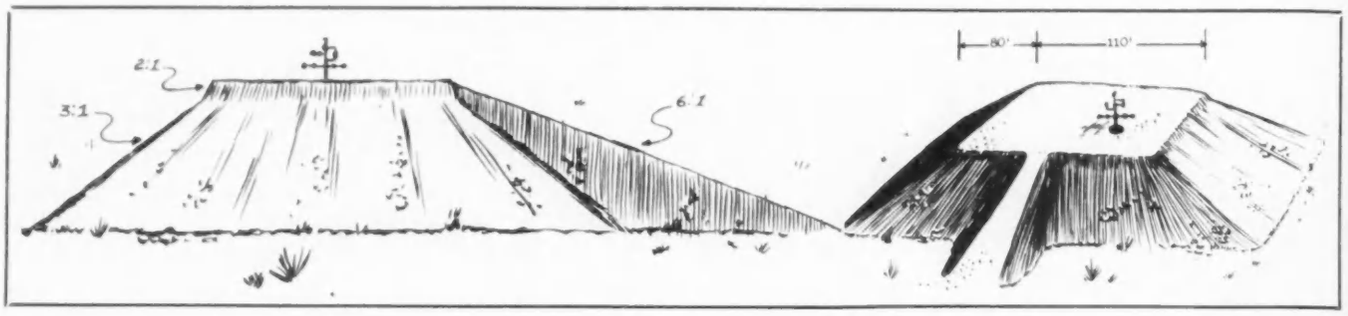


FIGURE 2. For locations staked for future wells, this pyramid-type earthen mound is being built. Just enough area is allowed for drilling rig.

drilling mound, and has a surface dimension of about 80 feet in diameter. Slopes of the sides and ramp are identical with the pyramid shaped mound described above. All mounds are rip-rapped with sandstone boulders, the same type of protective layer as used in the dam itself for protection against erosion.

Drilling From Mounds

Drilling from top of the mounds is not unlike conventional drilling practices in the field. Only deviation from normal practices is in the casing program. A short surface string is set down below the bottom of the mound to prevent drilling mud and spud water from washing out the bottom of the mound.

Completion Practices

An unusual procedure is followed in completing wells which are drilled from the original ground level. When the oil string has been set and the well drilled to total depth, the braden head is removed and both strings of casing are elevated some 35-40 feet in the air. It is necessary to raise the inner string first and then thread the outer string over the first. The well head is then replaced and tubing is run from this elevated position up in the derrick. This phase is illustrated in several photographs of the operation. It is mandatory that the drilling mud be in excellent condition during the raising procedure, since the pay has been drilled and the casing is open to the atmosphere. The bottom-hole pressure in this area is approximately 2760 pounds per square inch. If swabbing is necessary, it must be done from the elevated position, which is inconvenient to say the least.

Flow Lines

The Colorado River Municipal Water District requires that flow lines be welded, coated, wrapped and buried. They must be tested to 1000 pounds psi. Since most flow lines seldom have over 20 pounds pressure on them, this precaution should eliminate any danger of a flow line break in the future. In all probability, most operators will install storm chokes or safety chokes on all wells in the lake area for added protection against polution.

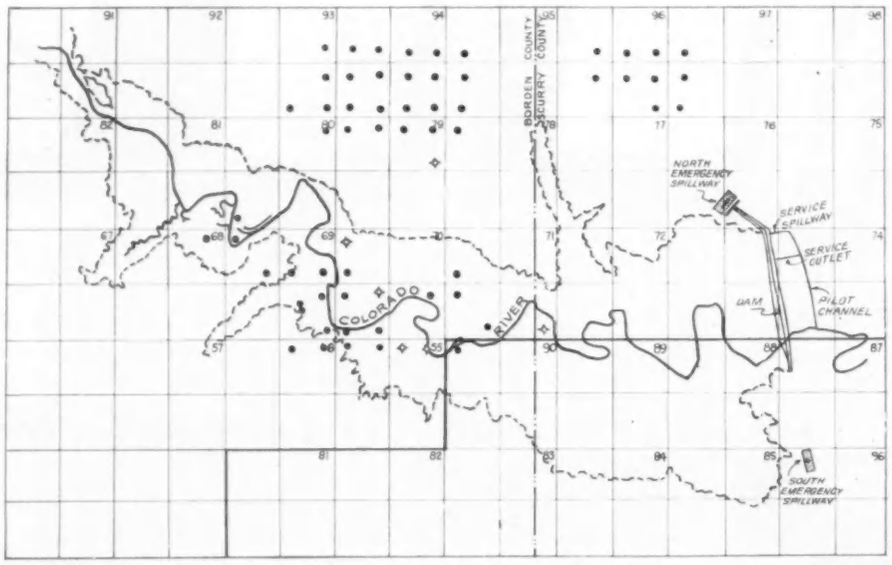
At this writing there are two beam units pumping from these man-made mounds. When the lake is ultimately filled with water, the maintenance of these wells will necessitate the use of a barge large enough to transport a pulling machine. Hydraulic pumping systems are being considered by some operators to minimize barging maintenance operations. However, since most wells are brought into production by flowing, the pumping problem for the present is a minor one.

Lake Size

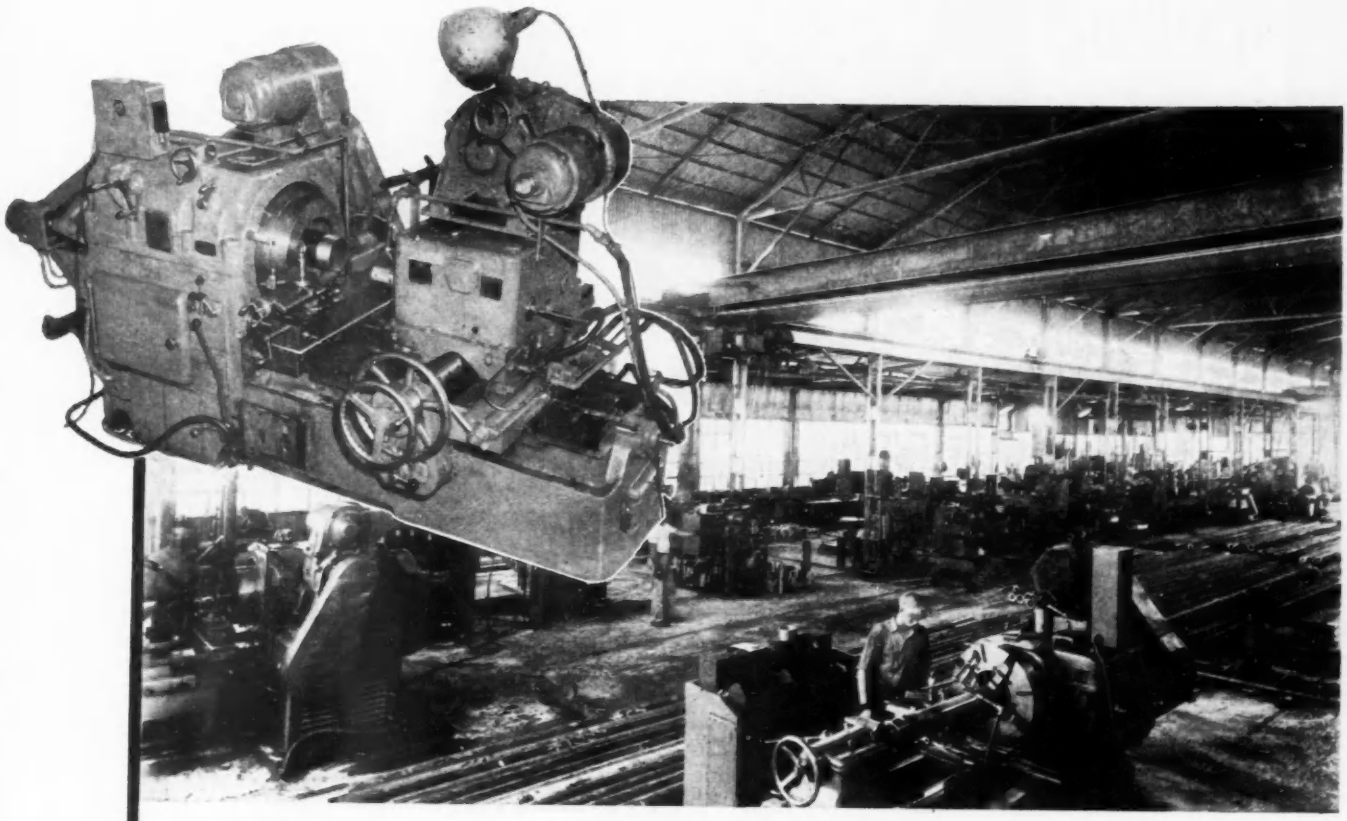
Thirteen wells have been completed so far in what is to be Lake Thomas. Locations have been staked for other wells which will be located in the lake area and will be drilled in the future. The lake will cover 12½ square miles and will contain 204,000 acre-feet of water or 66 billion gallons. The dam has a maximum height of 105 feet and contains more than 4 million cubic yards of dirt and more than 100,000 cubic yards of rip rap.

Look To Gulf Coast

The project of the Colorado River Municipal Water District is the second such project in West Texas that has brought about unusual production practices for this normally arid country. Fort Chadbaume field in Runnels County offers a similar problem. The presence of large bodies of water covering oil fields is something new to operators and personnel in that area. Undoubtedly, the problems arising in the inundated area of the Von Roeder field extension will be quite similar to many of those found in the Gulf Coast fields of Louisiana, and much of future operations in Lake Thomas will very closely resemble those of the Louisiana counterpart. It is to be expected that many phases of the West Texas marine operations will be copied from those of the swamplands.



This will be Lake Thomas. Broken line shows proposed water area. Dots are oil wells.



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Scurry County Unitization Plan

MORE than one billion barrels of oil can be brought to the surface during the next 40 years for the benefit of royalty interests and lessees alike under plans of the Scurry Area Canyon Reef Operators Committee, nearing final stages of completion. This compares with about 500 million barrels that will be recovered under present methods of production, according to reservoir estimates based on volumes of data assembled to date. Bisecting Scurry County in West Texas, the area involved is about six miles wide and 18 miles long and incorporates 1227 wells and more than 47,000 acres. The plan to participate in a pressure maintenance program is nearing completion with the lessees operating more than 90 percent of the working interest having approved. More than half the 65 percent royalty interest signatures necessary to the proposal have been affixed, and the completed plan is nearing the final stage preparatory to presentation before the Texas Railroad Commission.

Data Study Valuable

Studies of engineering data by more than 200 engineers representing the operating oil companies and private individuals having interests in the project, is estimated to exceed in volume and importance the data collected for any other repressuring and unitization plan in the industry's history.

While the painstaking engineering data has taken months and unlimited hours of research to prepare, the final rewards for the landowners, the owners of oil royalty interests and producing companies will be great under the unit plan.

In other fields where unitization and pressure regulation have been accomplished, the Railroad Commission of Texas has in some instances eliminated shutdown days and has increased the allowable otherwise in other instances. It is believed that similar treatment will be afforded to this Scurry County unit because it can be produced at a higher rate without waste under the unitization and pressure regulation.

Rapid development after discovery late in 1948 resulted in a tremendous volume of new oil being thrown on the Texas market and caused the Railroad Commission of Texas, working with the operators, to seek all data possible to instigate measures that would insure maximum conservation.

Survey Ordered in 1950

In March 1950, the commission ordered a bottom hole pressure survey of all wells in the field at six months intervals and wells have been shut in regularly for this purpose since that time to record bottom hole pressures in the reservoir.

These engineering surveys showed, by a commission statement, "pressures are dropping abnormally" from an original 3122 pounds to 2850 pounds in 1950, and at the present time average 1675 pounds—about half the original pressure. It has been noted that losses of pressure after original tests in 1950 have been as high as one percent of the original BHP every 10 days of production.

As a result of these pressure tests, the Railroad Commission called two hearings to "show cause" why the field production rate should not be reduced and asked the operators to explain plans for oil and gas conservation. These hearings, in April and November of 1950, accelerated the operators' development of a unitized pressure maintenance program. As a result of engineering data presented, the operators organized a factual data engineering committee and a pressure maintenance advisory group that recommended and led to the formation of the Scurry Area Canyon Reef Operators Committee (SACROC).

Later in 1950, the commission approved an experiment to inject water for pressure maintenance in a portion of the Diamond "M" field. The data gained by this test confirmed the unanimous conclusion by more than 200 SACROC engineers that the Canyon Reef was adaptable to pressure regulation through surface injection of water and gas, and the engineers recommended a formula for unit participation of all operators and royalty interests in the field.

This SACROC participation formula is important. Since the field has been developed almost to its full extent, recognition of existing wells have been given by a well factor of 25 percent in the formula. Since there is a great variance of reef thickness in different parts of the field, that variance has been recognized in the gross acre foot factor of 75 percent. The two factors combined do equity and justice to everyone and are universally accepted in the industry as an equitable means of sharing in a common reservoir of this type.

Efficiency Rate Reduced

As a result of the noted pressure declines and for other conservation reasons, the maximum efficiency rate of production was reduced by the Railroad Commission from 220 barrels per day in 1950 to 160 BPD, and later to 100 BPD, all in one year, and has held production at this daily rate since, subject to statewide shutdown days.

It is generally believed that the

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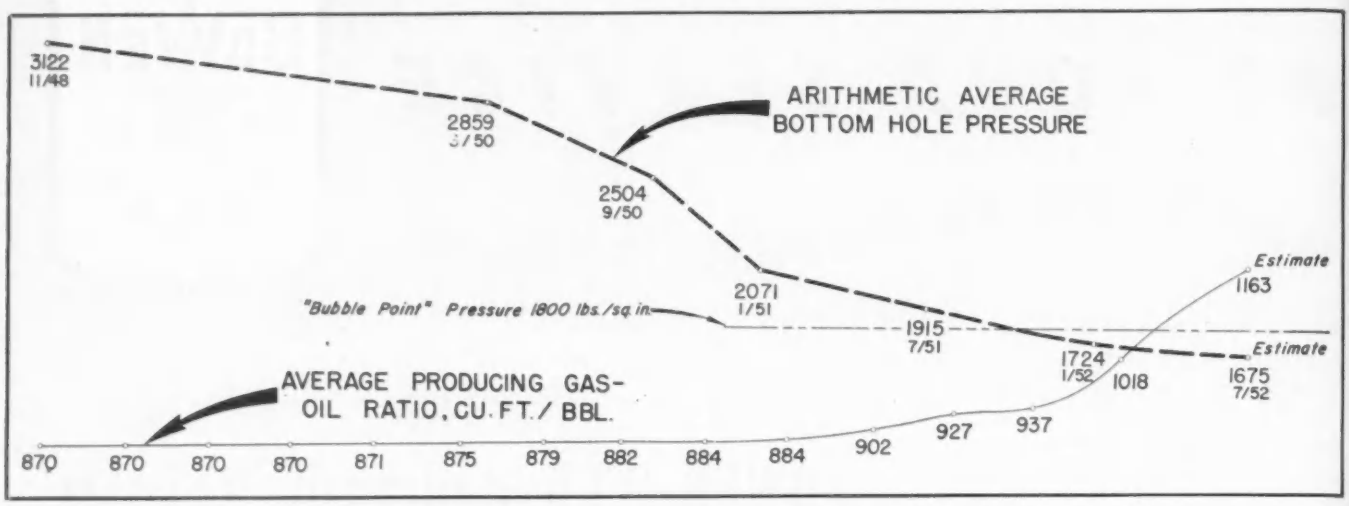


FIGURE 1. Gas-oil ratio and bottom-hole pressure history of Scurry area reef fields.

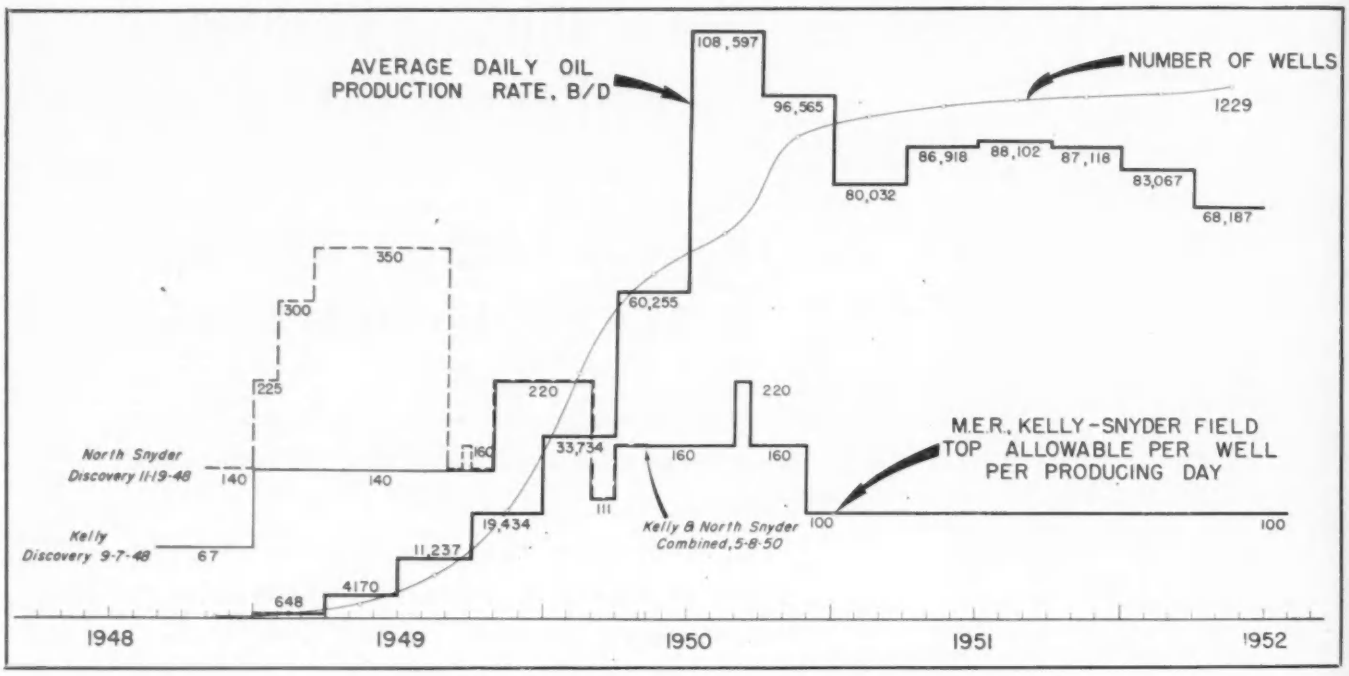


FIGURE 2. Production history of Kelly-Snyder fields of Scurry County.

production rate would have been, by now, cut below the 100 BPD if the operators had not reported excellent progress toward unitization.

Peak production in the field was up to 108,000 BPD in the first quarter of 1950 but with reductions in allowables, it has dropped to approximately 80,000 BPD on a calendar day basis. It now is more or less stationary at this figure although a drop in the second quarter of 1952 was necessary because of the strike in the nation's refining industry.

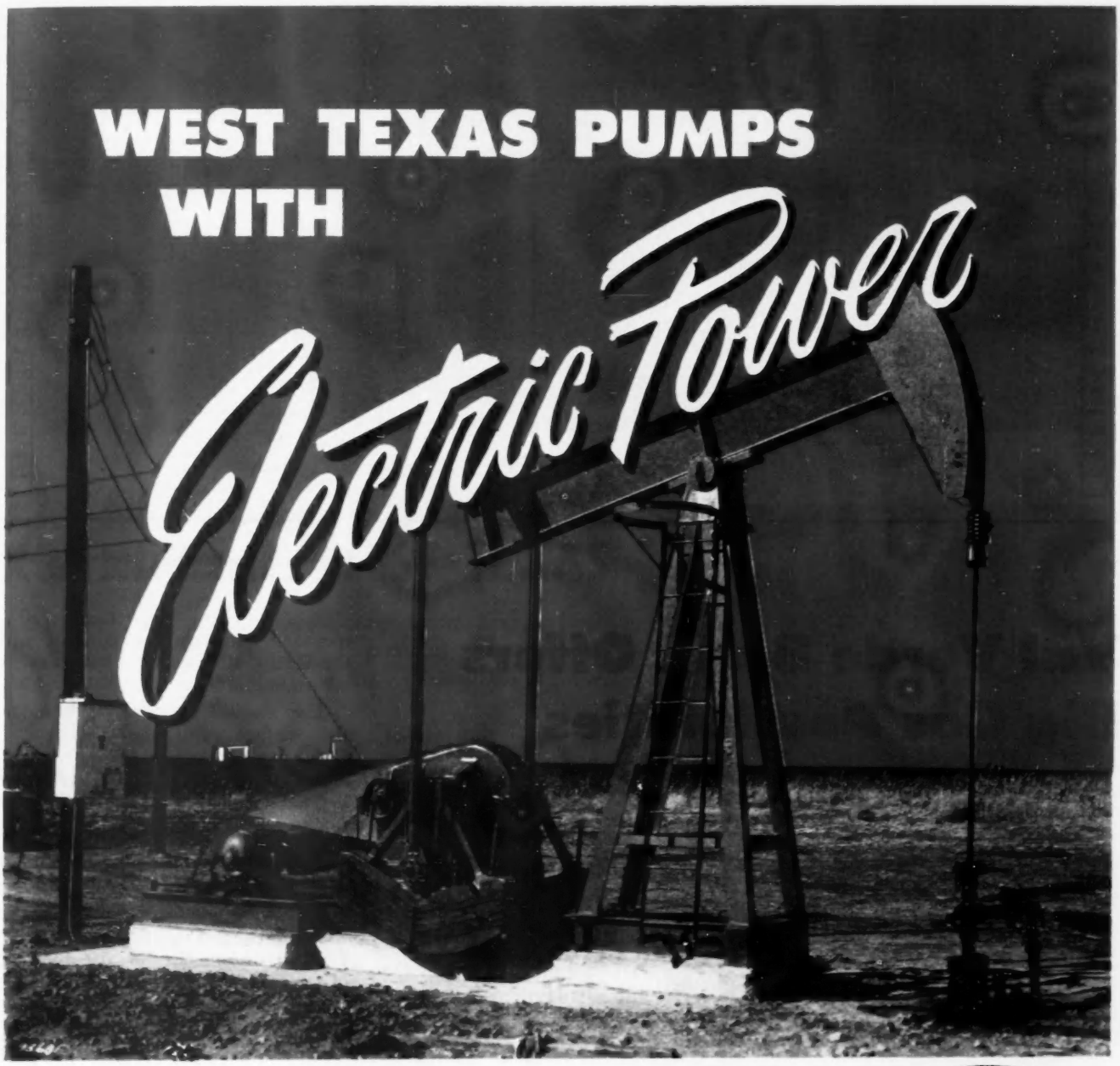
The oil industry universally recognizes that an increase in gas-oil ratio is an index of approaching inefficiency and waste in production. The gas-oil ratio increases noted in the Canyon Reef field for the first six months of 1952 indicates that the Kelley-Snyder-Diamond "M" reservoir has arrived at a point where injection of gas and water under a unit plan for field-wide repressuring is the only practical way to prevent future waste.

Engineering data establishes that the greatest increases in gas-oil ratio and decline in bottom hole pressure have been most pronounced on the edge leases of the Kelley-Snyder and Diamond "M" fields. While SACROC engineers observe that this trend is normal for the thinner reef sections, under the proposed long range unitization formula these edge leases will participate permanently in the production of oil from under the entire unit.

Engineering data supporting the plan are shown in Figures 1 and 2. The Kelly-Snyder and Diamond "M" fields are virtually completely drilled up on the spacing pattern at the present time. A significant factor which makes unitization under pressure maintenance desirable is the drastic drop in bottomhole pressure from 3122 pounds in 1948 to 1675 pounds. In the meantime, gas-oil ratios have increased from 870 to 1163 cubic feet per barrel. Some 108,697 barrels per day were produced at the peak in 1950, but proration under maximum efficient rate of production, now set at 100 barrels daily per well, has seen this drop to about 80,000 barrels per day.

Undoubtedly this project will be a costly one and will require a long payout period. However, the end results—more oil to the nation and more profit to the landowners, royalty interests and to the operators—make this project an outstanding achievement in reservoir engineering and marks another milestone in unitization progress in West Texas.

WEST TEXAS PUMPS WITH *Electric Power*



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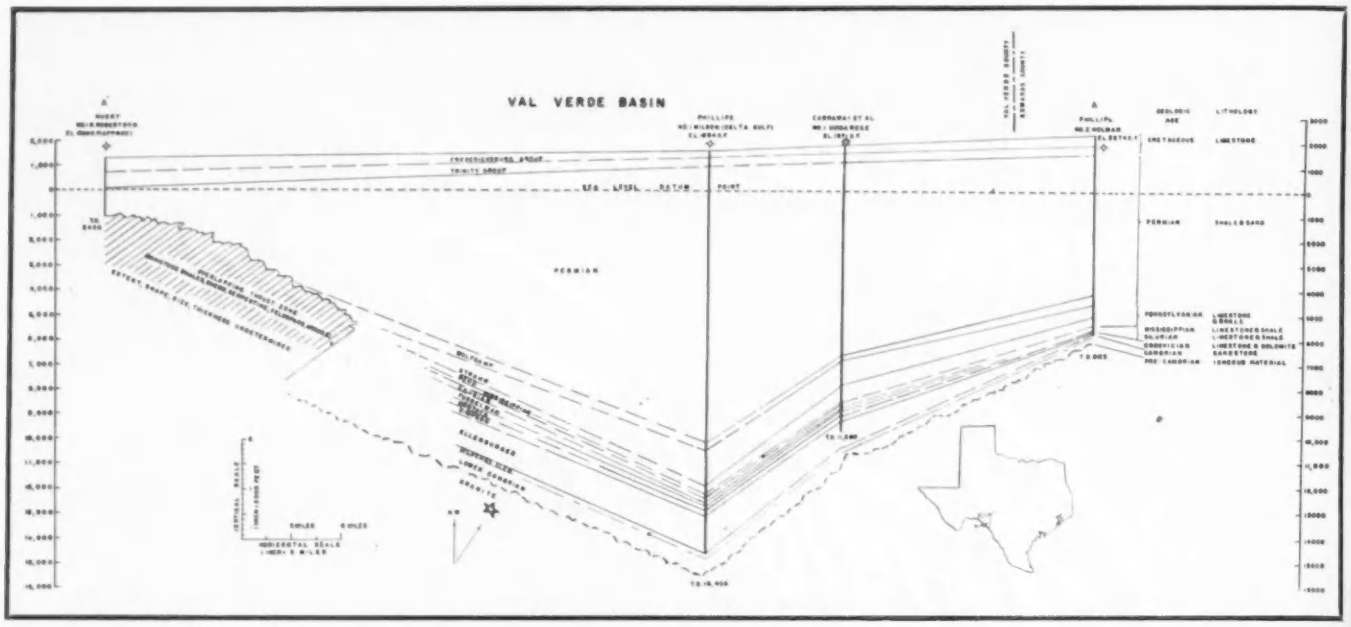


FIGURE 1. Northeast to southwest geologic cross-section of Val Verde Basin.

Val Verde Basin Offers Big Gas Possibilities

- **Excellent gas possibilities in Strawn lime.**
- **Good chance at oil in Edwards lime.**
- **Good possibility of oil in Wolfcamp.**
- **Fair chance for gas in Permian sands.**
- **Shallow oil in northeast shelf.**

By JOHN K. PETTY

Western Natural Gas Company, Midland, Texas

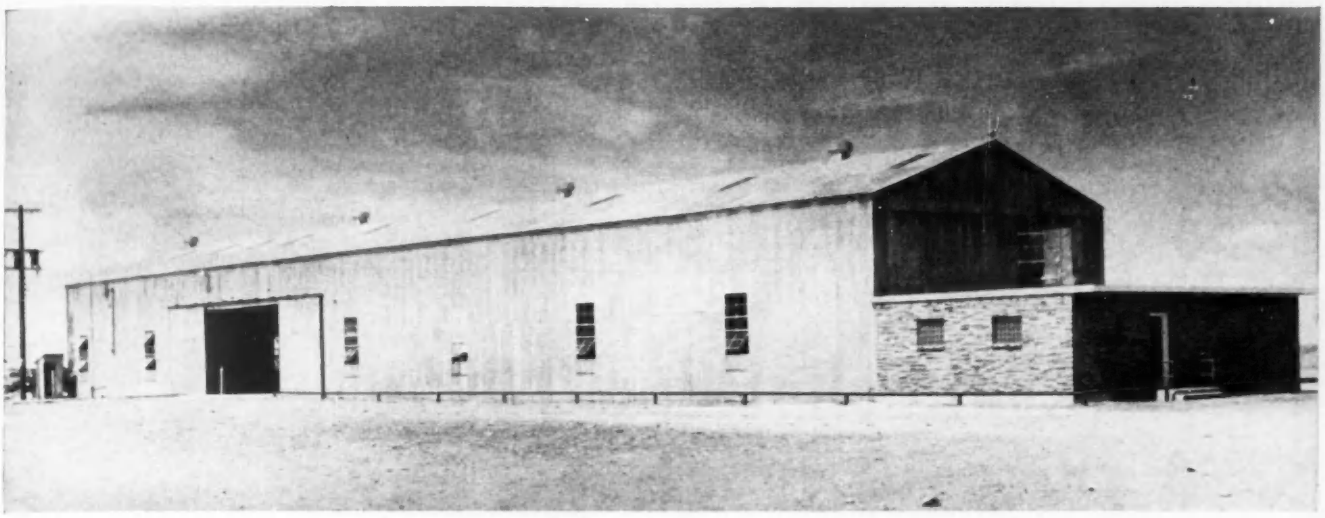
DISCOVERY of one big gas well this year, shallow accumulations of oil, possibility of Edwards Lime as a source bed for oil, great thicknesses of sedimentary shales and limes throughout the area make the Val Verde Basin of Val Verde County, an almost virgin area for important new oil and gas fields in West Texas. Favorable indications of gas reservoirs coupled with the increased demand for gas from West Texas, foretell of an accelerated exploration program in Val Verde Basin.

Gas structures will probably be anticlines and perhaps a few domes. Possibility of finding more structures in the north and northeastern shelf region is excellent. It is highly likely that future drilling will result in discoveries of huge gas potentials from the Strawn lime. This will very likely become a reality in the not-too-distant future as many operators and companies are becoming more interested in the area.

The Edwards lime is possibly a source for its own oil since it is such a huge depository of organic remains. Great thicknesses of sedimentary shales and limes offer an unlimited source of petroleum. Southern part of the basin contains a huge thrust zone about which little is known. Sedimentary beds making contact with the thrust offer good possibilities for oil accumulation.

The lower Cretaceous is found at the surface, and the Wilberns, a Cambrian sandstone, has been penetrated in the deepest well yet drilled in West Texas. The Val Verde Basin is young in petroleum exploration and development. Three gas wells, one potentialling 35 million cubic feet daily, have been completed from the Strawn limestone in the Vinegarone area, in the northeast part of Val Verde County, which is in the northeast part of the basin. The northern and northeastern shelves of the basin offer excellent possibilities for many gas structures in the Pennsylvanian lime. The large gas well discovery in the Vinegarone area had dead oil stain in the Wolfcamp sandstone, indicating that oil had migrated and may be found in that formation in a higher part of the structure.

Deepest well in West Texas was recently completed as a dry hole in the deeper part of the basin, nine miles southwest of the Vinegarone area. There are several shallow, low gravity oil wells pumping from the sandy lime of the Edwards formation, in the Holman and Turney fields of northwestern Edwards County, being on the northeastern shelf of the Val Verde basin. Deeper Permian gas shows were reported in the Holman Field in 1931 but the well was abandoned. Thus, in the north and northeastern part of this basin, there are excellent Strawn gas possibilities, fair Edwards lime oil possibilities, slight chance for oil in the Wolfcamp and



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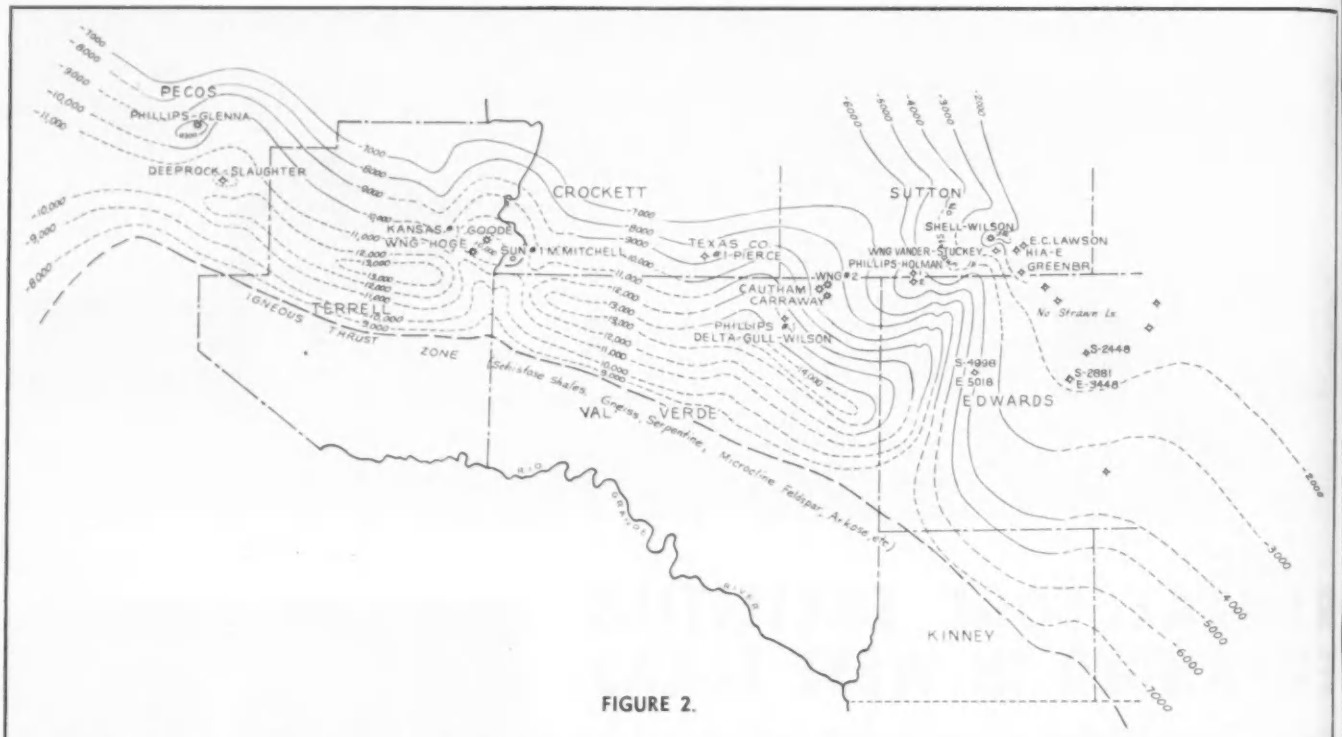

FIGURE 2.

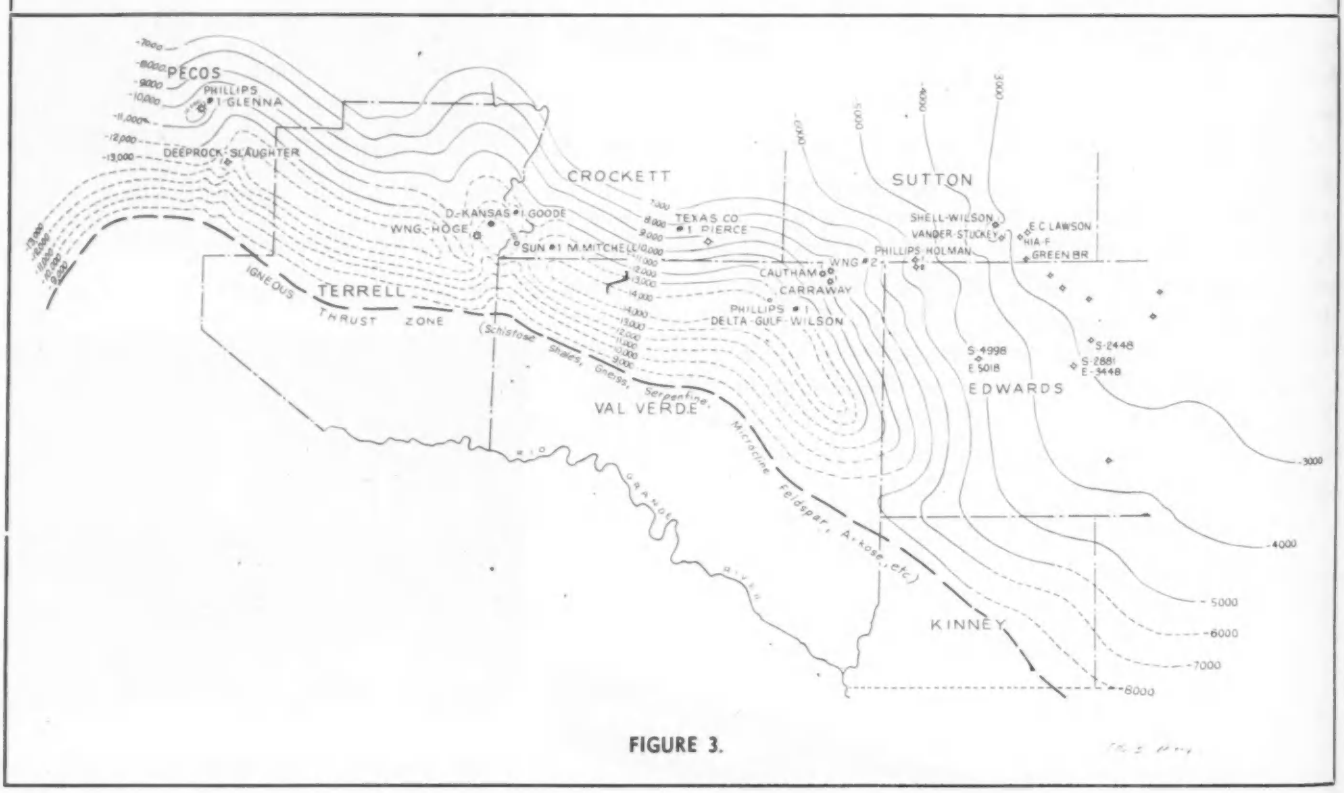

FIGURE 3.

faint chance for gas in the Permian sands.

On the south part of the basin is the huge thrust zone (Figure 1), about which little is known. Only well drilling will reveal the true extent and size of this feature. Very little mention of it is made because so little is known about it. Where the sedimentary formations make contact with it petroleum accumulation is certainly possible.

On the extreme north shelf in southern Crockett County the Pierce Gas area has a well which potentialed around 5 million cubic feet of gas in Ellenburger dolomite. As a result, the Ellenburger on the north shelf of the basin offers good petroleum possibilities.

Description of Basin

This huge basin lying 50 miles southeast of the Permian Basin engulfs practically all of Val Verde County, (Figures 2 and 3) except the extreme southern part. The deepest portion, over 16,000 feet deep, extends through the heart of the county, from the northwestern through the southeastern part taking in some of southwestern and northwestern parts of Edwards and Kinney counties respectively. The Pandale anticline in East Terrell and West Val Verde counties serves as a northwestern boundary to this basin, partially separating it from the Sheffield channel. It is almost contiguous on the northwest to the Reagan uplift at its

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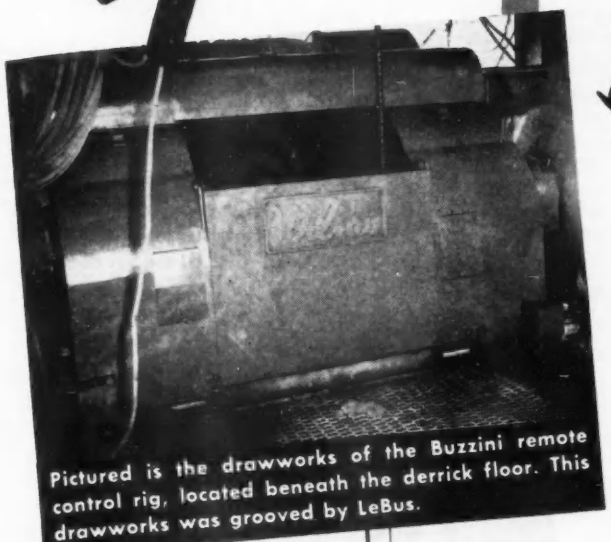

Pictured is the drawworks of the Buzzini remote control rig, located beneath the derrick floor. This drawworks was grooved by LeBus.

This is a derrick floor view of the Buzzini rig showing the remote control panel on derrick floor with drawworks beneath the derrick floor.

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southern extremity. Its northern shelf extends into the southern part of Crockett County and on the east into Edwards County. The Edwards Arch gently noses into it just as it unites with the Kerr basin in the southeast. The gigantic, much-referred-to, thrust zone forms the basin's south and southwestern shelf.

The northeastern shelf has the only wells yielding oil at this time. The shallow Holman and Turney area in northwestern and western Edwards County are yielding the low gravity oil from the Edwards lime in small quantities, part of the oil being trucked to tanks in Sonora, Texas, and shipped by rail from there. Gravity of this oil is usually around 19 degrees Baumé. If a gas injection program could be successfully initiated in this sandy lime and perhaps raising the gravity of this oil so it could be easily produced, it would surely stimulate exploration to a great degree as this zone extends over all the basin and surrounding country. Surely there would be many new fields discovered and developed.

Significant Tests

Just north of this Holman shallow oil field, still in Edwards County, is the Phillips 2 Holman, Section 25, in the CCSD&RGNG survey, an Ellenburger test which had gas shows in the Permian. This well was plugged in 1931 and while modern engineered acidizing might not have made it a large well, it probably would have increased the gas content immensely. A sample log of this well is shown in Figure 4.

The well which caused the Basin to become popular in recent months was the R. J. Carraway, Western Natural Gas, Wier et al 1 Guida Rose, a northwestern Val Verde County wildcat, section 2, of the GC&SF survey. It potentialed 35 million cubic feet daily on a Railroad Commission test. There are two Strawn lime stringers each around 50 feet thick which produce this gas (Figure 5). The lower one tested the 35 million cubic feet daily and the upper one

State: Texas; Company, Phillips Petroleum Company; County, Edwards; Farm, J. S. Holman; Well: 2; Section 25; Survey: C.C.S.D. & R.G.N.G., 330' E. & 2310' S; Total Depth: 8123; Commenced: 3-22-30; Completed: 4-17-31; Altitude: 2274 SW; Production: P. & A.; Casing record: 13¾" 2380 Set; 8⅝" 4075 Set; 20" 434 Set; 15½" 839 Set; 10¾" 2724 Set; 6⅝" 6688 Set.

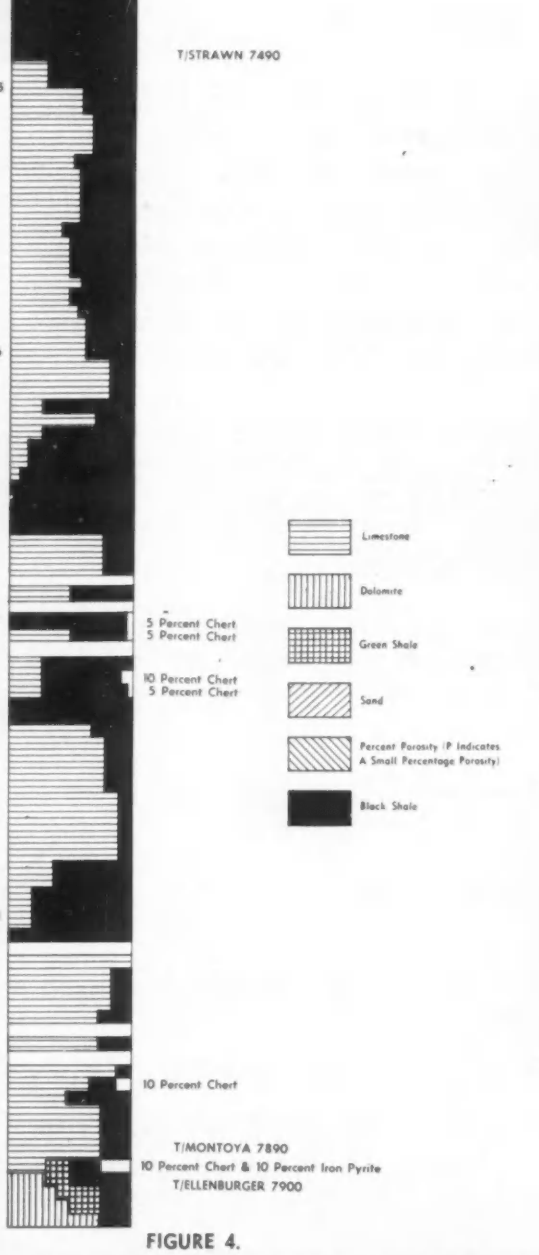


FIGURE 4.

State: Texas; Company: Reagan Carraway; County, Val Verde; Farm: Guida Rose; Survey, GC & SF, 2310 FNL & 330 FEL, T.P. 10,080; Total Depth: 11,590; Contractor: D & E Exploration Company; Commenced: 7/31/50; Completed: 5/12/51; Altitude: 1971 D.F.; Production: 35 Mcf PD; Casing Record: 8⅝" 566 w/75; 5½" 10,515 w/500; 10¾" 428 w/400.

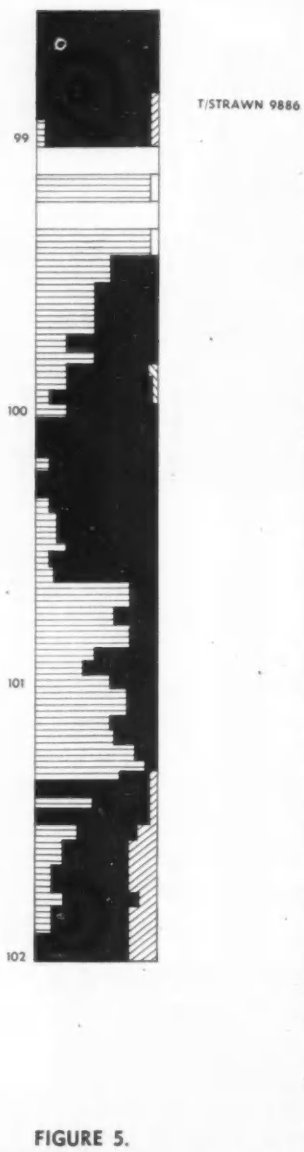
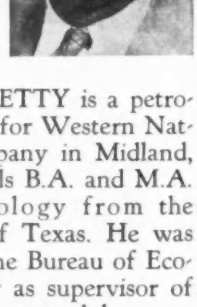


FIGURE 5.

About the Author



JOHN K. PETTY is a petroleum geologist for Western Natural Gas Company in Midland, Texas. He holds B.A. and M.A. degrees in geology from the University of Texas. He was employed by the Bureau of Economic Geology as supervisor of a mineral survey, and later assisted in geological surface mapping of a part of the Llano uplift. After serving four years in the U. S. Army Corps of Engineers, during the year following his graduate work, he worked in North Texas. In the spring of 1948, he went to Midland where he has performed a variety of jobs as petroleum geologist.

tested about one-third of that amount without acid treatment.

Two more wells, the Western Natural Gas et al 1 and 2 Addah Cauthorn, Section 9 and 10, GC&SF survey, were drilled approximately one mile north and northwest of the Guida Rose location. This gas and gas from the Guida Rose 1 are practically the same, being mostly Methane. These smaller wells are low to the Guida Rose well and each tested about 5 million cubic feet of gas daily. Most likely there will be more gas discovered in wells drilled later around the Rose well.

The 1 Guida Rose penetrated its Strawn pay around 9900 feet. It was an Ellenburger test. Between 8600 and 8800 feet there was some dead oil stain detected in what is called the Wolfcamp sand in this article. It is thought that higher on this same structure there is a possibility for oil to be found in this zone. This horizon thus offers another zone for exploration and possible development of petroleum in this great basin.

In the extreme north central shelf on the basin, in Crockett County, The Texas Company 1 Victor Pierce, Section 10, Blk 000, in the GC&SF survey, tested 5 million cubic feet of gas daily from the Ellenburger, at around 12,000 feet.

In what is possibly the deepest part of the basin in north central Val Verde County, the Phillips 1 B. E. Wilson (Delta Gulf), Section 82, Block E, in the GC&SF Survey, drilled to a total depth of 16,456 feet penetrating Wilberns sand of Cambrian Age, without finding any shows. Since the top of the Ellenburger dolomite and Pennsylvanian lime of this well coincided with regional contours (Figures 2 and 3) it is doubtful if it was located on a structure. It is thought that if a well is drilling on a structure in the deeper part of the basin, it should have a possibility of finding gas in the Pell Pennsylvanian lime or the Ellenburger dolomite.

General Geology

The Wilberns glen, a Cambrian sandstone, is as far down as the deepest well in the basin penetrated. The Ordovician consists of limestone, green shale, sand and dolomite. The Ellenburger dolomite is very porous, having an abundance of cavernous porosity in the Phillips 1 B. E. Wilson (Delta Gulf). The Ellenburger is shown contoured in Figure 3. It had 1555 feet of section in this well. The Ellenburger shows to dip westward at the rate of 280 feet per mile from the number two Holman (Figure 1) to the Guida Rose and thence at the rate of 400 feet per mile to the 1 B. E. Wilson (Delta Gulf).

The Silurian is represented by limestone and shale, and the Devonian is absent or as yet undifferentiated. The Mississippian consists of limestone and shale in the basin.

The Pennsylvanian consists of black shales, sandy shales and light gray to tan to dark gray, almost black fossiliferous limestones. The Strawn lime in the Guida Rose well is devoid of chert and is very likely a true reef lime on this structure. It is thought that the Strawn age material is present over the whole basin but in many places entirely off structure it will consist of hard calcareous black shale while in other localities perhaps abundant lime secreting organisms flourished thus leaving a lime reef structure which was an ideal trap for petroleum.

The Pennsylvanian lime dips 200 feet per mile from the Phillips Holman to the Carraway, Western Natural Gas Company, Harvey J. Wier et al 1 Rose and then it dips 438 feet per mile from there to the Phillips 1 Wilson (Delta Gulf), Figure 1. The Pennsylvanian Lime is shown contoured on Figure 2. The Strawn is known to be the first lime penetrated in the Pennsylvanian section in the northeast shelf but in the western and southern parts it is thought the Strawn is represented by shale thus letting the Bend become the first Pennsylvanian lime top. Present just above the Pennsylvanian shale is the Wolfcamp sandstone, hard and quartzitic and slightly porous.

Then the Leonardian Permian begins just above the Wolfcamp. It consists of sand and shale as well as sandy shale. It is not correct to definitely state that the Leonard age Permian is found just below the Cretaceous because of lack of paleontological evidence, but it is perfectly possible that it is the Leonard instead of the Guadalupe.

The greater part of the surface of the basin consists of Edwards and Georgetown limestone. In the extreme south, the Del Rio clay will be found on the surface. Surface mapping seems more proficient for finding structures in the Cretaceous but they do not reflect the structural attitude of the deeper zones. Seismic, gravity meter and aero-magnetic surveys have been tried in this region, but to date, evidence of their success is in no manner common knowledge.

ACKNOWLEDGMENT

Appreciation is expressed to Western Natural Gas Company for permission to publish this article.

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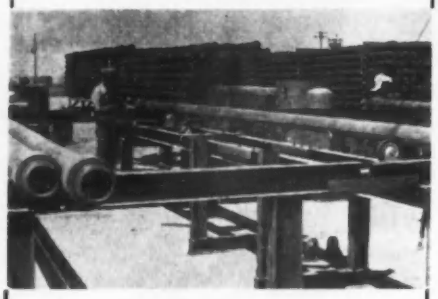

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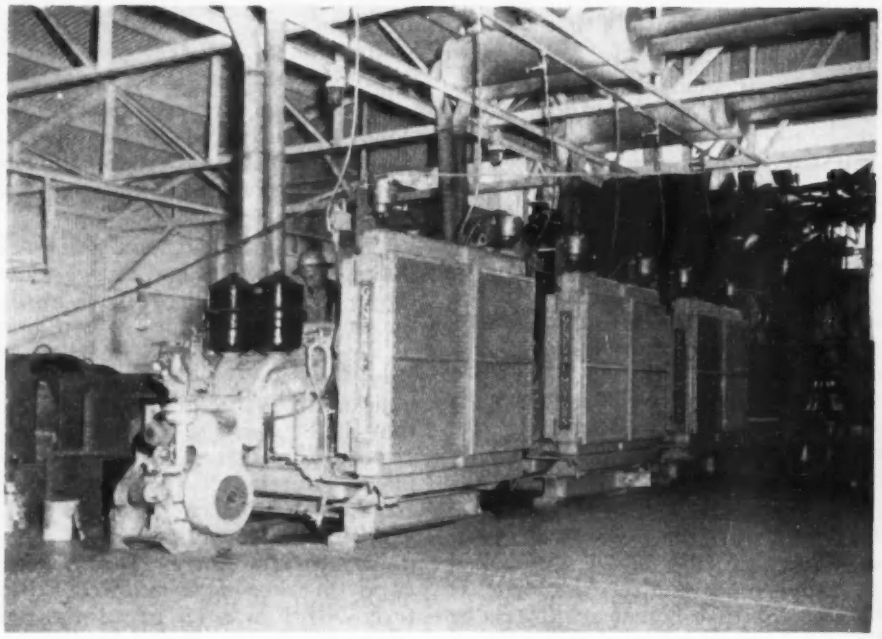

Drilling engine radiators, although one of the least expensive major rig components, will become a financial burden if maintenance programs are not inaugrated. For just a few dollars each month, the operator will benefit by reduced expense and better engine performance. Remember, too, that radiator scale or corrosion damage is relayed to engine and can mean high maintenance and replacement costs.

SAVE That Radiator

Few dollars each month for maintenance program can increase life 80 percent.

By A. S. WUKMAN
President, Coastal Engineering and Equipment Service, Houston

WORRY WITH treating engine radiators? To some people such practice doesn't make sense. They feel that after all, radiator cores are one of the least expensive items on a drilling rig. However, casual inspection of price sheets reveals that the average set of cores for drilling engines costs near $1000. And that's just for one engine. In this light, there must be value in the inauguration of inexpensive preventative maintenance programs for intelligent radiator care. Aside from this factor, have you tried to buy a radiator core recently? Pretty scarce, aren't they.

The proper conditioning of engine radiators can extend field service life as much as 80 percent. Circulating undersirable water through a radiator core can and often will destroy the elements within a matter of weeks. So, the following discussion is offered as a "word to the wise" with the thought of furthering economy drives currently of interest to the drilling contractor.

Result of Proper Maintenance

It is essential to have the water jacket free of rust and scale deposits

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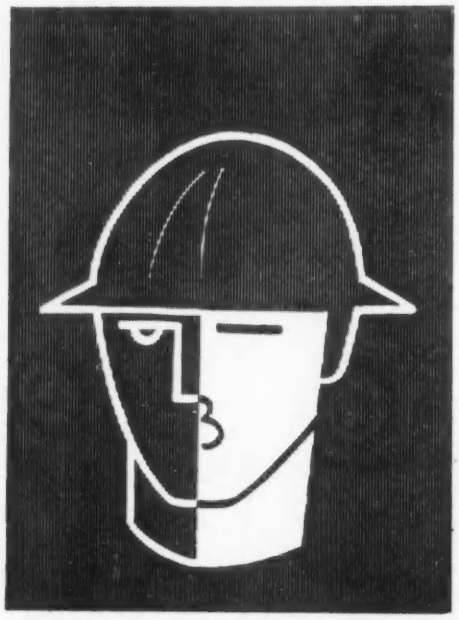

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to reduce the possibilities of motors developing hot-spots in the combustion chamber due to improper cooling. Water will not properly cool the system if the small passages are not open to allow free circulation. These conditions will lead to excessive carbon formation in the combustion chambers and deposits around the ring grooves and valve stems causing these parts to malfunction. The prevention of these conditions will aid greatly in reducing the overall unit maintenance cost. In turn, unit service life will be extended.

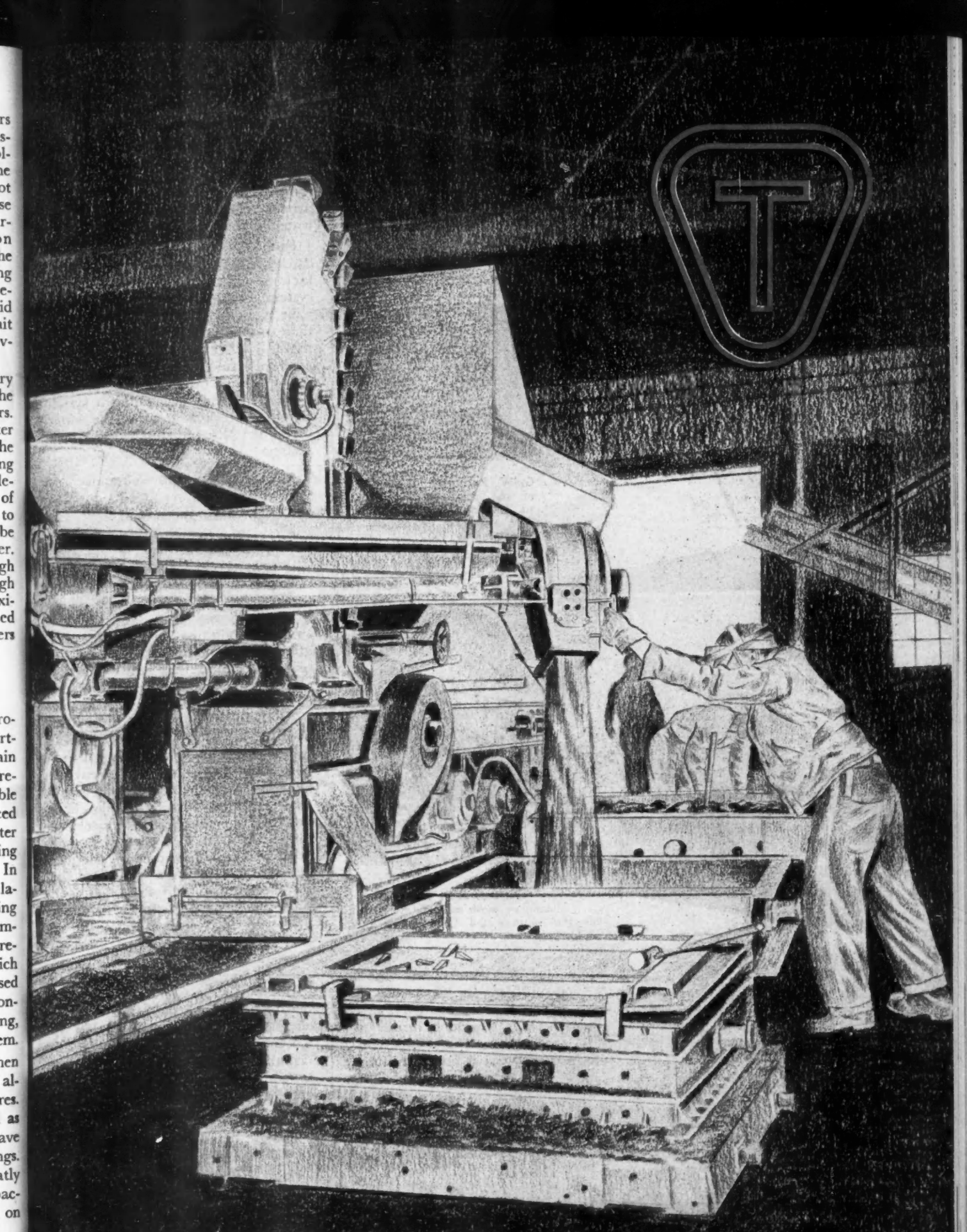
Presently, drilling and stationary operated motors often circulate the water through small cooling towers. Low temperature circulating water does not necessarily mean that the motor combustion chambers are being properly cooled. Scale and rust deposits prevent the proper cooling of combustion chambers as they tend to retard the amount of heat that can be picked up by the circulating water. The transfer rate of heat through scale is much lower than through metallic surfaces; therefore, the maximum cooling can only be attained by having the water jacket chambers free from rust and scale deposits.

New Units Scarce

The topic of efficient radiator protection becomes increasingly important since it is more difficult to obtain new units. The cost of radiator repairs may run into a considerable amount. These costs can be reduced greatly by first having a clean water jacket chamber, and then treating the water properly in the system. In a clean motor system, water circulation will give maximum motor cooling which results in lower circulating temperatures. Lower temperatures will reduce the amount of water which evaporates from the system. Decreased evaporation losses will prevent concentrations, which increases scaling, from building up in the motor system.

In operation there are times when the overflow from a radiator is allowed to run down over the cores. This practice should be prevented as the water will evaporate and leave scale deposits in the air openings. Clogging these openings will greatly cut down the radiator cooling capacity since proper cooling is based on air passing through the core.

It has been found that a majority of the radiators on drilling rigs shows corrosion around the core base and top where they had been sealed with



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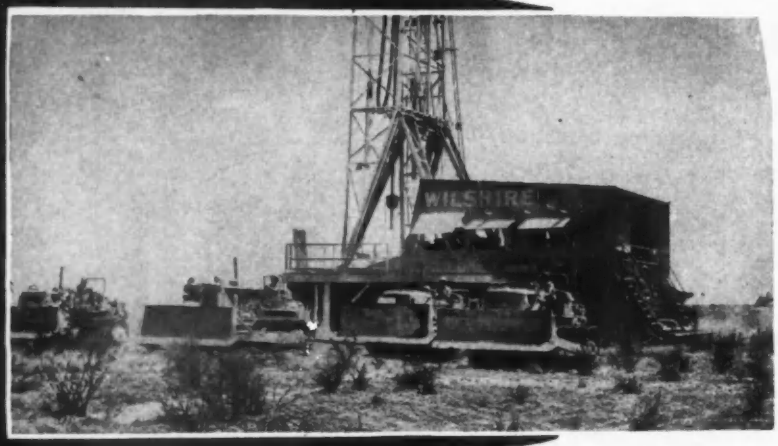

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acid core solder. This type corrosion will be found to occur more readily in areas where the water being used is a low pH. Counteracting this type failure can be best approached by proper chemical treatment of the water in the motors.

From the foregoing discussion, one can conclude that they are several factors which contribute to cooling system problems. It is essential to have a clean circulatory system and then to maintain this system clean by the use of properly treated waters. The following discussion covers a recommended outline for maintaining a clean system. In cleaning a system and then properly treating the water, there are three distinct operational phases:

- Cleaning system to remove rust and scale.
- Neutralization system.
- Treat system for scale and rust prevention.

In the cleaning phase it is desirable to flush out the motor water jacket to remove rust, scale and deposits. Prior to beginning the cleaning operation, it is advisable to check and plan procedures that will be used to correct leaks which may develop while cleaning. Hose and gasket connections should be checked for tightness because after the cleaning solution begins to remove scale and rust, there will often develop several leaks in openings which had been plugged by these deposits. Precaution should be taken in the selection of the cleaner to be used. There are several standard cleaning compounds on the market; however, it is recommended that a compound should be selected which is blended for the specific situation. Following the cleaning phase, the system is treated with a neutralizing compound to compensate for the excess cleaning solution adhering to the metal surfaces. Composition of the neutralizer should be based upon the cleaning mixture used and the type water in the system. Following the cleaning and neutralization, the system should be washed and then treated water added with a prepared scale and rust inhibitor compound.

Cleaning Operations

It is best to clean motor systems while the units are in use. Cleaning compounds will function more effectively at temperatures exceeding 160 degrees and in cases where the cooling systems are at a lower temperature, it is advisable to cover the radiators.

Cleaners generally are one of two types, one type acts better on rust

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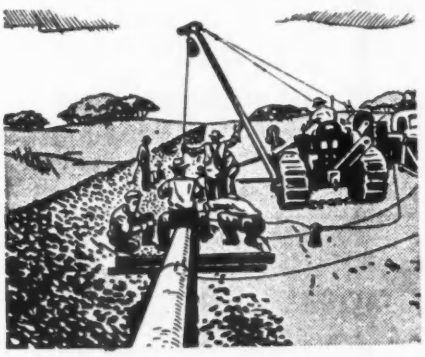

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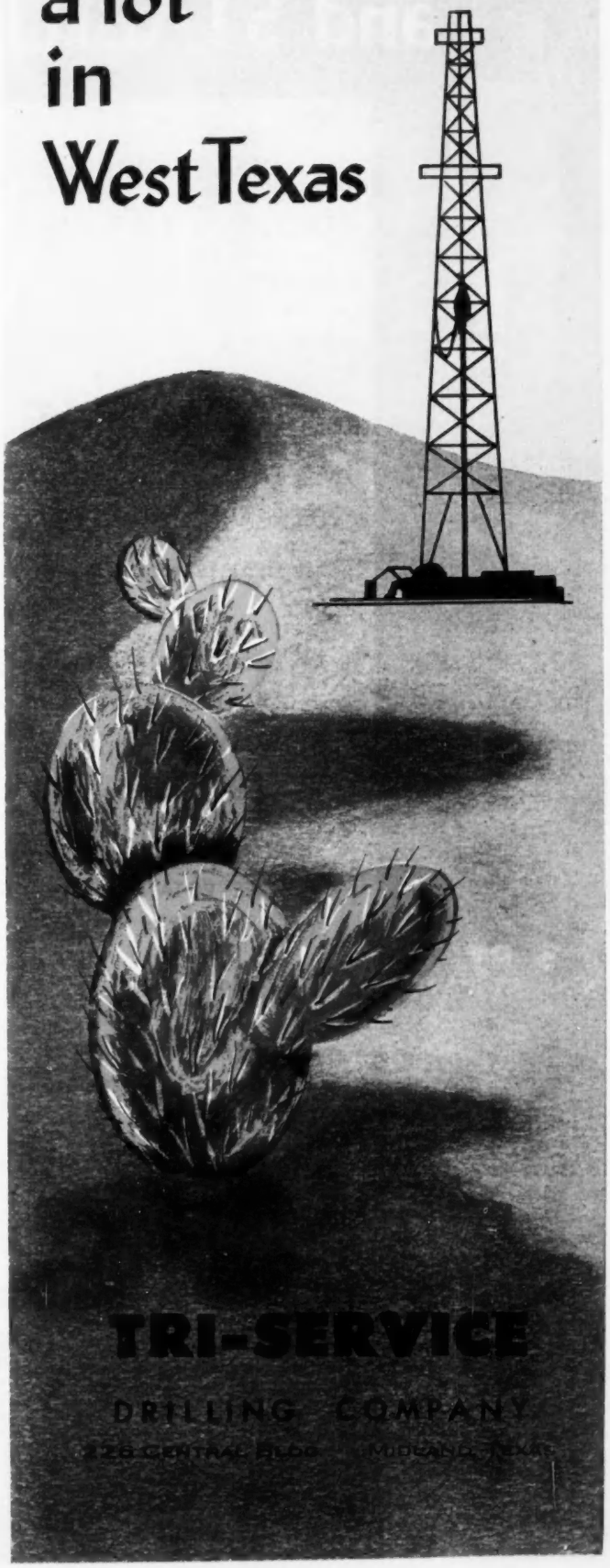

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deposits whereas the other type acts best on scale deposits. Therefore, a blend of these will generally work effectively and the proportions must be based upon condition of the system to be cleaned. The amount of cleaning compound used should be one pound with four to six gallons of water. This will give a sufficiently concentrated cleaning solution to satisfactorily remove rust and scale. In badly rusted and scaled conditions, it may be best to use a smaller quantity and then perform the cleaning again following 30 days operation.

On typical jobs, the cleaning compound is blended and a charge of one pound per five gallons is placed in the motors. This is allowed to remain in the system from four to six hours operation and then the cleaning solution is drained from the motors. In draining, it is best to have all valves open at the same time.

After the cleaning solution has been removed, refill the system with water and neutralizing chemical. One pound of neutralizer should be used for each five to seven pounds of cleaning chemical previously employed. The neutralizing chemical should be based upon the cleaning compound used and the makeup water characteristics. This precaution is essential as the neutralizer may treat calcium and magnesium out of the water and leave an undesirable deposit in the water jacket chambers. The neutralizing solution is allowed to remain in the system from 30 minutes to one hour of operation and then the systems are drained and flushed thoroughly before new water is introduced. The water is then treated with an inhibitor which will prevent further formation of rust and scale deposits in the water jacket chambers.

Inhibitor Important

Having the motor system clean, they are then charged with an inhibitor compound to treat the water against scale and rust formation. Inhibitors also suppress internal corrosion. An inhibitor blend having an alkalizing, softening and sequesting action is best to use.

Efficient inhibitors will import the following reactions:

- Water pH adjustment or neutralization of acid characteristics.
- Prevent scale deposits by sequestering action of chemicals.
- Remove dissolved oxygen with passivators.
- Protective coating against corrosion.

In inhibitor action, it will be found that at least two of the above reac-

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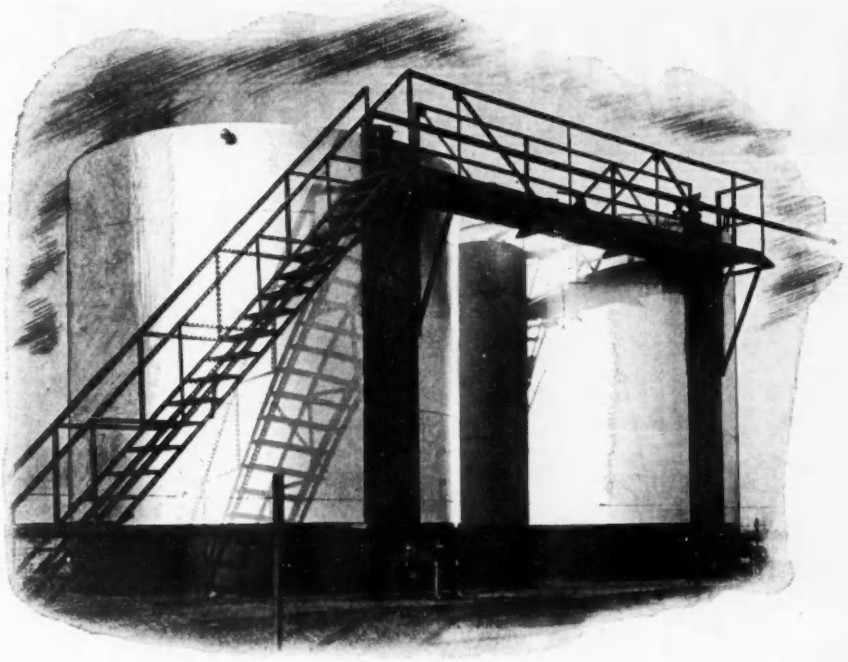

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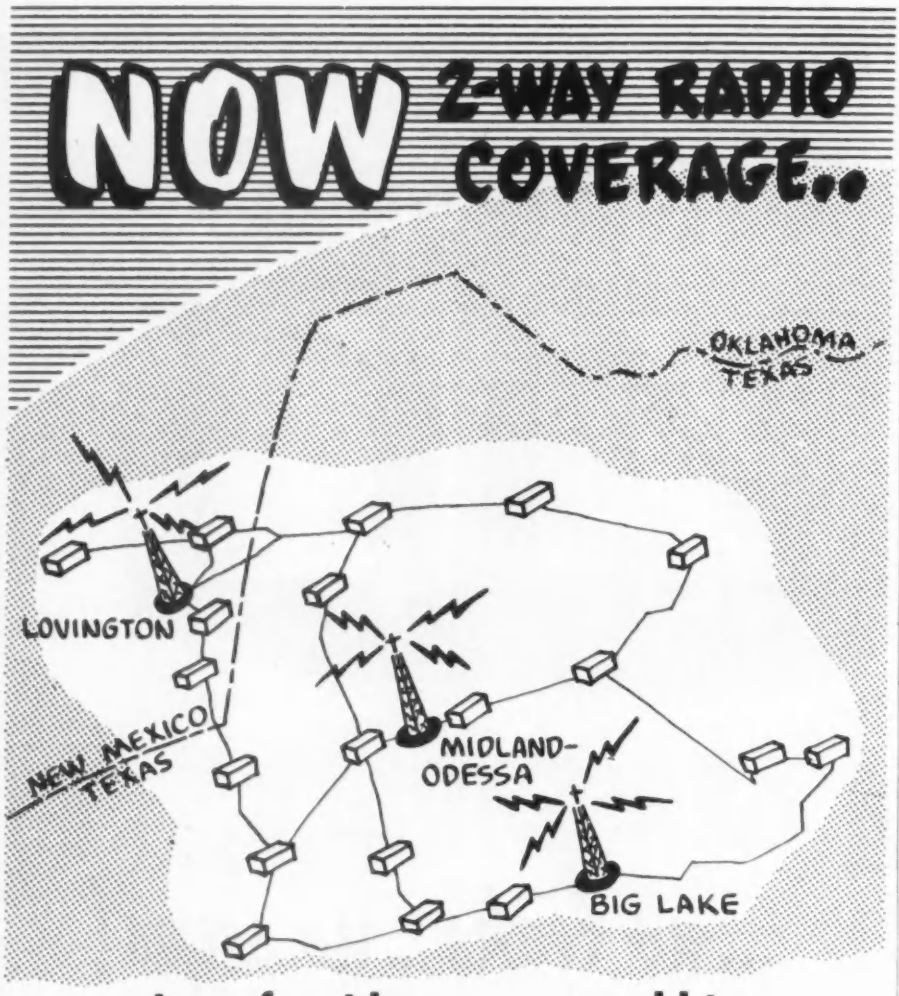

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tions generally occur simultaneously.

The pH adjustment of waters having acid characteristics is very desirable since the tendency for motor systems to rust is much greater in this type medium. Neutralizing acid characteristics can be accomplished by using various type alkalizing chemicals such as alkaline phosphates, sodium silicate, soda ash or caustic soda. Precaution should be taken with soda ash, since its use in high calcium water can create a dangerous amount of scale in the water jacket chambers. Use of sodium silicate may prove to be advantageous as it establishes a silicate type scale which will prevent corrosion. Alkaline phosphates are desirable to use when the alkalinity is not too high; however, their use for alkalizing is generally prohibited due to the high cost. It is wise to mention that the elimination of corrosion around acid-soldered connections is suppressed or eliminated by increasing the pH, thus rendering the water alkaline in nature.

Stop Scale Formation

In order to prevent formation of harmful deposits, water in the system must be treated with the properly blended chemicals. Scale formation is contributed by insoluable deposits formed with calcium and magnesium ions present in makeup waters. Prevention of this scale formation can be insured by the use of a phosphate type of chemical with softening and sequestering properties in a specific water. In water with a hardness exceeding 500 parts per million calcium and magnesium, this type treatment may not provide satisfactory results and other treating methods may be required to remove the scale forming calcium and magnesium from the water. Where phosphates can be used, the chemical action keeps the scale-forming substances in suspension and may even produce considerable cleansing action upon existing deposits in the system.

Dissolved Oxygen—Corrosion

Dissolved oxygen is generally coped with by the use of an oxidizing passivator type compound. The formation of a protective coating on metallic surfaces for anti-corrosive purposes is a topic which is becoming increasingly important. There are several chemicals which may produce a protective coating on a metallic surface; however, this discussion intends to bring out a few facts concerning the use of chromium chemicals for this purpose. Chromates possess the property of being able to form a very

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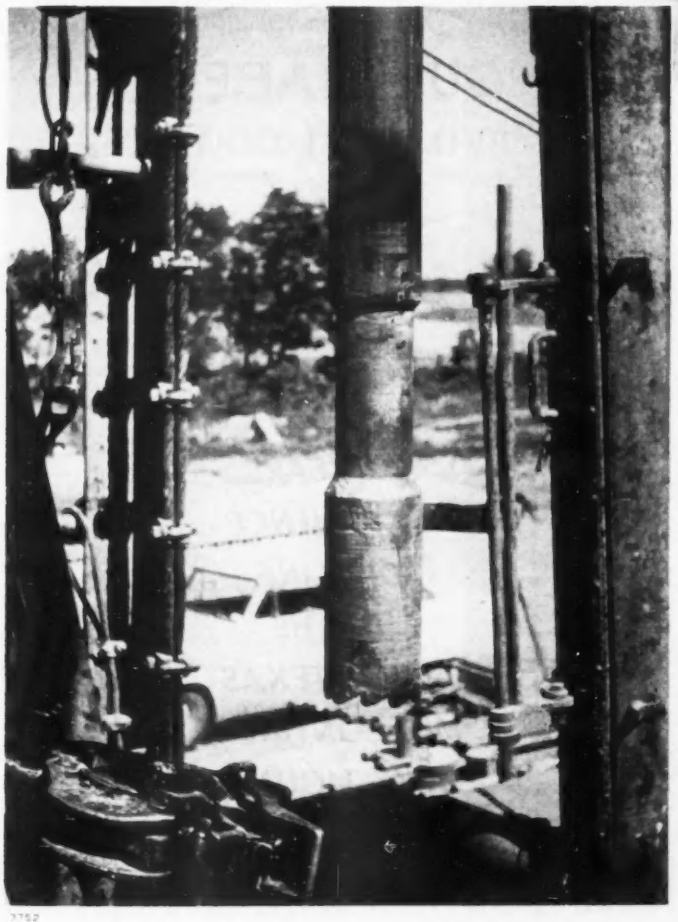

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closely adhering protective oxide film on metal surfaces and are highly effective in preventing corrosion. Chromates were first employed on iron and steel surfaces, but have recently found use on bimetallic surfaces.

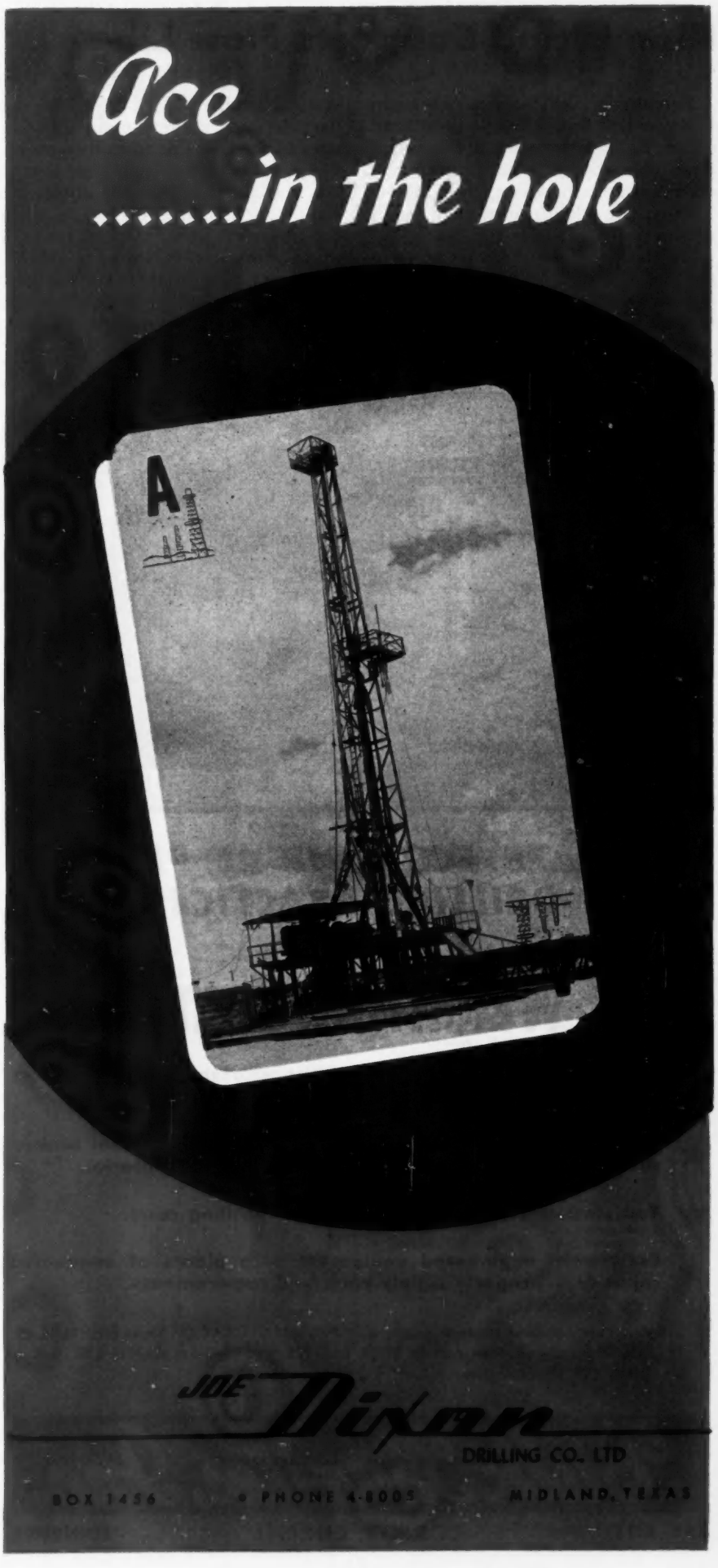
Concentration of the chromate ion in solution will depend upon each individual application. New systems require less than old corroded systems likewise, the water corrosive characteristics must be considered. In the use of chromates, water pH should be maintained in a range between 7.5 and 9.5 for maximum effectiveness. It is important to keep the chromate concentration high at all times to assure the desired inhibiting action.

Source of the chromate iron may be the chromate or bichromate type compound. Cost and ease of use are generally the controlling factors considered in selecting chromate compounds. Chromates are more expensive, but a pH of 8.5 and do not require neutralization which is required when bichromates are employed. Inhibiting stationary, motor-cooling systems normally requires chromate concentrations within the 1000 to 3000 parts per million magnitude. For the initial charge on a recently cleaned system, the original concentration can be run up as high as 5000 ppm to assure good protective coating in the system. Control of the chromate content can be estimated by the yellow stain imparted to the water. On typical jobs, the initial charge is approximately 5000 ppm chromate and the results obtained are very satisfactory. A specially blended inhibitor solution is prepared for each specific water to give the desired treatment for the prevention of scale and rust in the motor-cooling systems. The inhibiting solution is added approximately every two weeks to establish the desired concentration in the system.

A Parting Word

It is hoped that this discussion will impress the operator with the merits of preventing scale and rust in motor-cooling systems. As mentioned throughout the discussion, each condition requires a definite survey before the actual work is begun, especially where internal cleaning is required. It is always advisable to have the operation supervised by someone familiar with chemical action to prevent the development of undesirable results.

The importance of proper radiator preventative maintenance again is emphasized by not only the great expense of new cores but the current scarcity of this equipment.



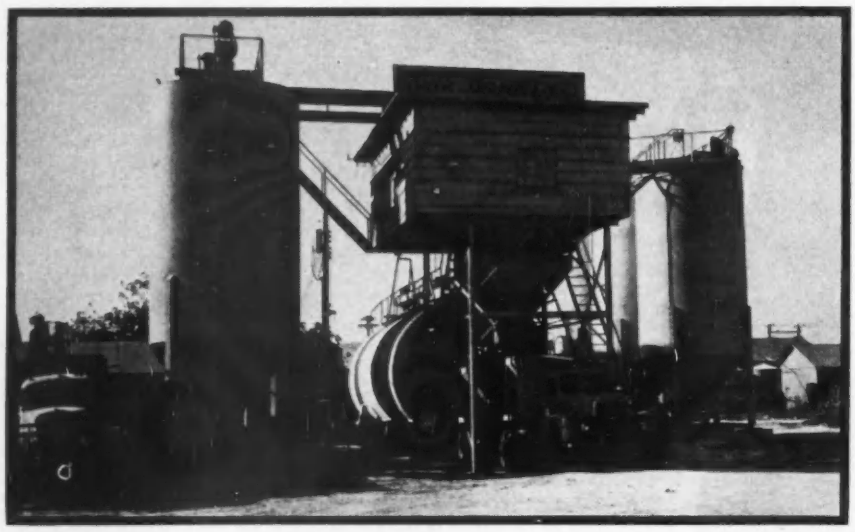
Pipe Stand Supports Flow Line

Supporting elevated flow lines can be simplified by use of the illustrated stand. Built with two-and three-inch pipe, the support is inexpensive and requires minimum space on rig moves.

First, cut one eighteen-inch length of three-inch pipe for the base. Two more shorter sections form the cross base for the support. A longer section of three-inch pipe is then cut and welded to the base to serve as the vertical support. The height of this part depends entirely upon the distance of the flow line from the ground.

A section of two-inch pipe is then cut and fitted within the three-inch stand. Each pipe is drilled to house one-half inch bolts, thus making the stand adjustable. It will be noted that the upper part of the two-inch pipe has been notched to fit a short section of rotary chain. The chain is welded in place and one pin is replaced with a small bolt to permit wrapping and locking the chain around the flow line.

In the event heavier flow lines are to be employed, it is recommended that three and four inch pipe be employed rather than the smaller size. The unit can also be anchored to the ground with wire line and turnbuckles if any line movement is expected.



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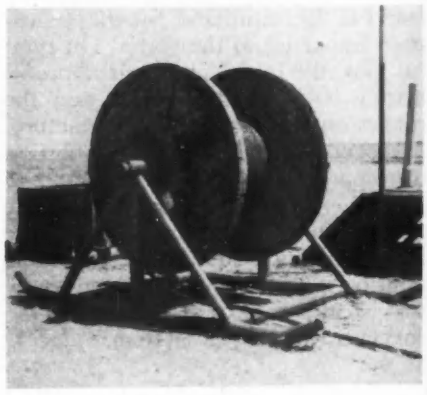

Rack Speeds Line Handling

The illustrated rack, which is constructed of three- and four-inch pipe, will ease wire line spooling and handling for moves. Simple in construction and inexpensive to build, this rack will also reduce the possibility of injury to crewmen when handling wire line spools.

The first step in building the rack is to cut the two runners a length which will reduce the possibility of the rack falling over when skidded. Each end of the skids is heated and

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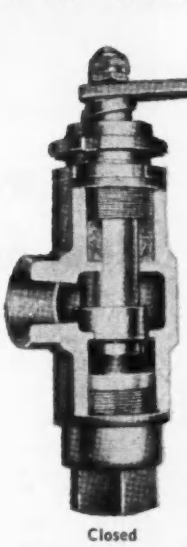

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bent to permit easy movement across the ground. At a point near the bend, a one-half inch pin is anchored to reduce the possibility of the line slipping when the unit is being skidded.

The two skids are tied together with two pipe spacers of the same size. The vertical supports, cut at length to lift the spool off the ground, are then welded atop the skids. Then, two diagonal supports are welded to the skid runner and the vertical support.

Final steps in completing the project consist of welding four-inch nipple retainers on top of the vertical supports. These retainers secure the three-inch pipe segment supporting the spool.

Each retainer is rigged with a lock nut to eliminate slippage in the spool support. Since the spool hub is of a much larger diameter, it is comparatively easy to rotate the spool to feed off or take up line.

Test Rack Aids Mud Engineer

Mud testing equipment can be stored and used conveniently in the illustrated metal bench. Stationed near the shale shaker and under shelter, the rack is within a short distance of the flow line. A small metal sink and running water add to the over-all convenience in testing drilling fluids.

The frame is made with discarded sucker rods while the heavy gauge sheet metal back is supported by vertical angle iron sections. Storage space has been provided for all essential testing equipment required around deep drilling operations.

Since the framework consists of metal rod, the over-all unit weight is such that two men can manage it on rig moves.

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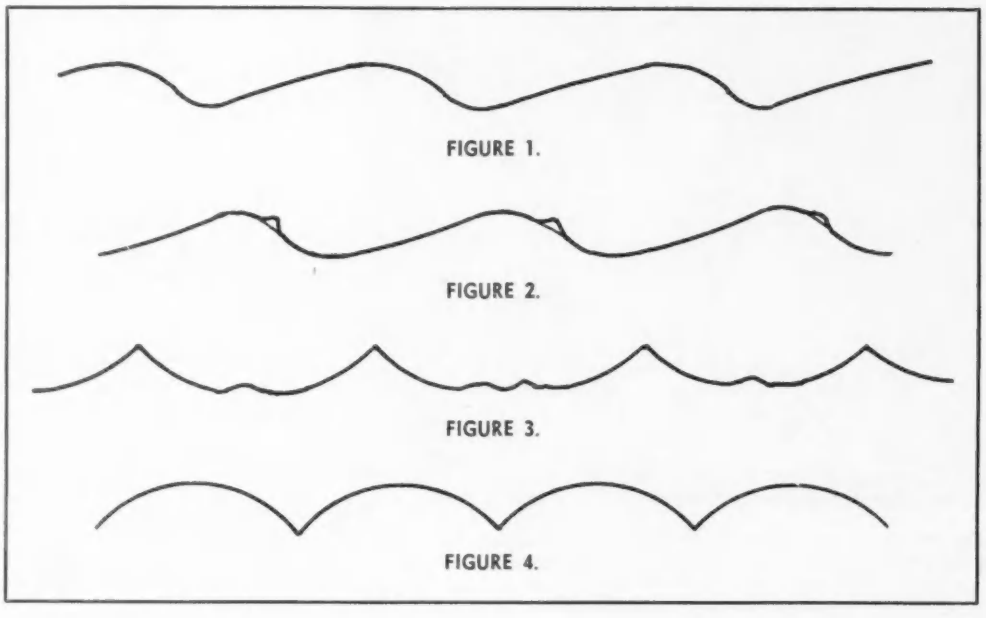


FIGURE 1.

FIGURE 2.

FIGURE 3.

FIGURE 4.

Ripple Marks Aid Geologists

Subsurface conditions reflect ebb and flow of ancient seas. Careful study provides data on how the rocks were formed.

By OREN F. EVANS
Professor Emeritus, Geology,
University of Oklahoma, Norman, Okla.

AMONG the many minor features of sedimentary rocks produced by moving water, ripple marks are perhaps the most useful to the field geologist. They are of widespread occurrence and, if carefully studied, will give much information regarding the conditions under which the rocks were formed.

They may be almost the only evidence of the presence of minor unconformities, they often furnish a clue as to whether the sediments are terrestrial or marine and, if wave-formed, they will usually indicate the direction of the old shoreline. Also, they sometimes furnish evidence of overturning of the rocks when other methods fail or are uncertain. Thus, in studying the Verden sandstone,[1] it was concluded from ripple mark indications that the formation had been laid down in tidal waters, that the prevailing winds had been from the southwest, and that the sediments were transported and dropped in a current moving from the southeast to the northwest.

Of course, in the older and better known areas, most of the surface study has been completed and is now being supplemented by instrumental methods but, in the newer areas, as in the present exploratory work in the Rocky Mountains, surface methods are still important. Unfortunately, much of the usable information regarding ripple mark still is widely scattered through the scientific journals. Even the most recent books on sedimentation give the subject little space.

The ripple marks which are found preserved in rocks were formed in one of three ways: (a) By the oscillatory movements set up by passing waves, (b) by water currents, (c) by wind currents.

Wave-formed Ripples

As wind-formed waves move into shallow water, they set up on the bottom a series of oscillatory movements. This gives to the sediments a backward and forward motion that, when continued for a short time, results in the formation of a series of ridges and troughs that are parallel with the longitudinal axes of the waves. In deep water, these backward and forward movements are equal in extent and velocity and so the resulting ripple marks are symmetrical in cross-section. But as waves move into shallower water and enter the breaker zone they change shape. Their fronts steepen and the backward and forward movements on the bottom become unequal in amount and velocity. This causes the formation of asymmetrical ripple marks with their steeper slopes facing in the direction in which the waves are moving. Thus, for some distance out from shore, the bottom of a sandy lake is usually covered with a belt of asymmetrical wave-formed ripple marks. These vary in size according to the depth of the water and the size of the waves that formed them. With increasing distance from shore they become more

Current-formed ripples in Pennsylvanian sandstone, Flat Rock Creek, Okla. Note streamlined ripple crests. This is certain evidence they were current-formed.

and more symmetrical until, beyond the zone of wave deformation, they are completely so. If only one set of ripple marks is formed, they will be smaller and smaller as the depth of the water away from shore increases. This is because the diameter of the orbital movement in a wave decreases with depth and so produces oscillatory movements of less amplitude on the bottom.

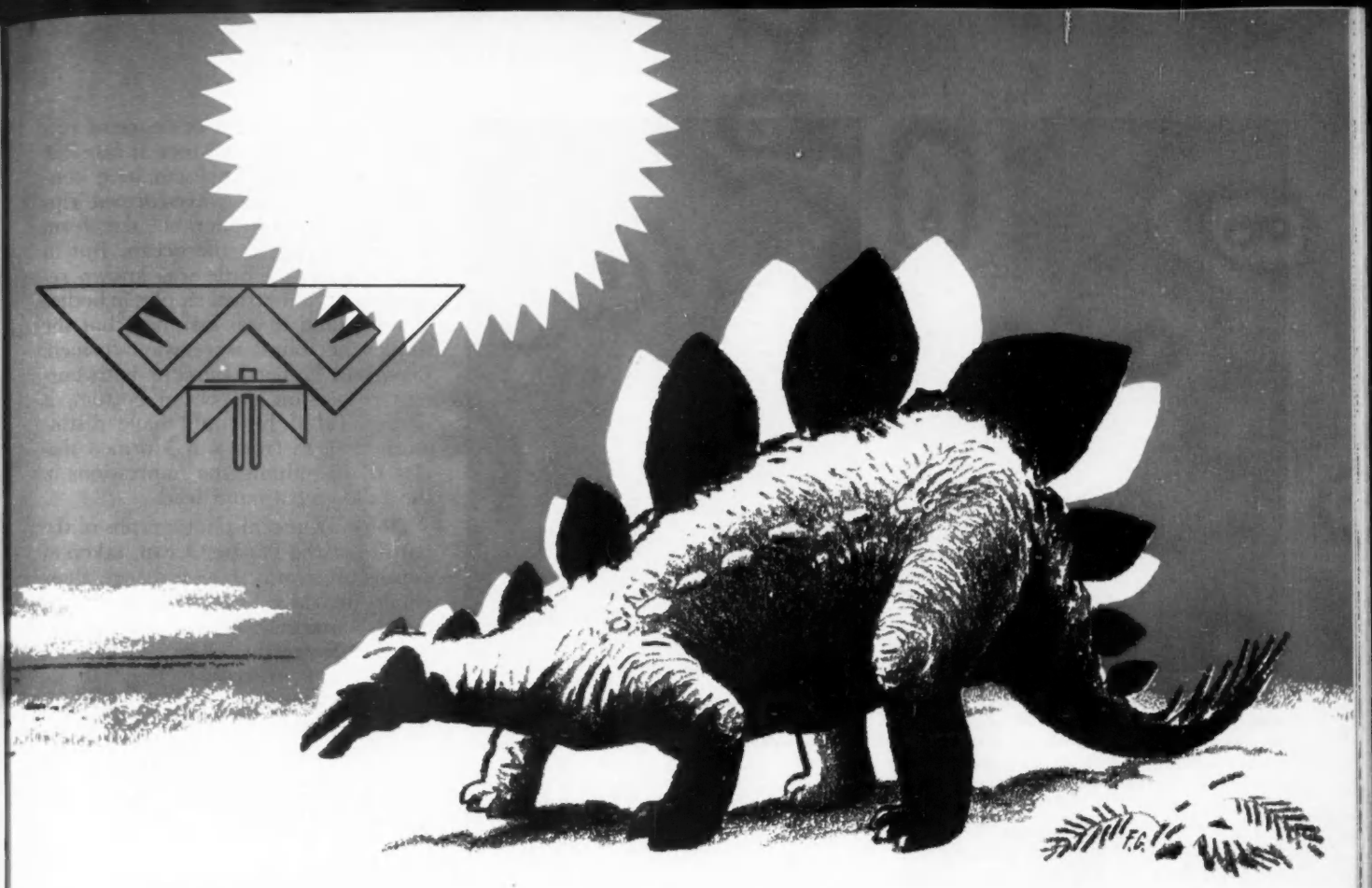
However, it often happens that strong winds are followed by winds of less strength and a set of smaller waves are formed. These destroy the large ripple marks near shore and replace them with smaller ones. But these smaller waves do not have the necessary energy for reworking the bottom in the deeper water offshore and the old marks, larger than the new ones near shore, remain. This might lead an unwary observer to the false conclusion that wave-formed ripple marks get larger with depth when the fact is that when produced by the same wave series they always get smaller.

It must be kept in mind that the size of wave-formed ripple marks is mostly the result of the operation of two variables—the size of the waves and the depth of the water, and that these also vary with respect to each other. With a given depth of water, the larger the waves the larger the ripple marks but, with a given size of wave, the deeper the water the smaller the ripples until, in ordinary sand, they disappear entirely at a depth of about ½ to ⅔ the length of the wave. From this it is evident that it is impossible to tell, by measuring the ripples preserved in a rock, the depth of water in which the sediment forming them was deposited.

As before stated, the oscillating movement produced by a wave decreases in amplitude and intensity with depth. At the depth of the length of the wave it is zero. So, in sand, ripple marks usually cease to form at a depth of about ½ the length of the wave because, below that depth, the backward and forward movements are too weak to move the sand grains. However, ripple marks never form in true mud. This is not because the material cannot be moved but because its particles are too uniform in size to allow the structure to build. Bagnold[2] discovered that sediments will not ripple if the particles are all of the same size. Wave-formed ripples

Ripple marks showing change in direction of flow in old Pennsylvanian stream.

Block of ripple-marked sandstone of Pennsylvanian age. Direction of flow shown by position of scale.



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Typical wave-formed ripple marks on lake bottom. Note sharp crests and rounded troughs. Ripples the reverse of these, with rounded crests and angular troughs, occasionally form in narrow belts near shore.

Asymmetrical wave-formed ripples close to shore. Irregularity is typical for near-shore ripples. A little farther offshore they are regular.

have been noted in what appeared to be mud but, on examination, it was always found to contain considerable sand.

Although, with a given size of waves, ripple marks get larger as the water gets shallower, large waves coming from deep water into very shallow water may cause so much turbulence as to prevent their formation. So it sometimes happens that when a heavy storm is succeeded suddenly by a calm, the bottom out some distance from shore may be smooth and free of ripples because the sediment thrown into suspension by the storm did not settle to the bottom until the wave action had ceased.

Wave-formed ripple marks may lie at almost any angle with the shoreline although they are usually nearly parallel with it. This is because of wave refraction which causes waves approaching shore in shallowing water to swing around almost parallel to it. However, with a very sharp change in depth at a little distance from shore, ripple marks have been known to turn at a right angle so that they were parallel with the shore close in and nearly perpendicular to it in the deeper water farther out. This should be kept in mind when trying to determine the direction toward the old land area by use of asymmetrical ripple marks. Their steep sides will usually be towards the old shore but a decision should rest on more than one observation.

Marks

Current-formed ripple marks are produced by land streams and also by the currents in lakes and oceans. Tidal currents are well known. Also, along the shores of water bodies, wind-caused currents are common. Ripple marks formed by water currents are asymmetrical in cross-section except in a very few special cases. If the current is gentle, their crests are usually somewhat rounded and they may resemble asymmetrical wave-formed ripples. But if the current is strong so the sand is moved rapidly down stream, their crests are often sharply angular.

Wind-formed sand ripples are also asymmetrical in cross-section but are seldom found preserved in rocks. However, McGee[3] has reported them present in the Coconino sandstone. They resemble, in cross-section, the asymmetrical wave-formed ripples in the long, smooth curves of their longitudinal axes. A way of distinguishing between the two is by measuring the ratio between height and width. Any ratios that can be given are only approximate but, in wind-formed ripples, the ratios between heights and distances between crests may vary from about 1 in 15 to 1 in 60 but, in water-formed ripples, it usually lies somewhere between 1 to 4 and 1 to 12.

In the past, there was considerable discussion among geologists as to the depth to which it is possible for ripple marks to form. The often quoted observations of Siau who, by use of the hand lead, found evidence of ripple marks at over 600 feet, is familiar to all geologists. This was long considered proof that wave-formed ripple marks of considerable size form at great depths in the ocean. But in Siau's time very little was known regarding asymmetrical ripples in bodies of water and it was assumed that the ripples he found were wave-formed. Even had he been familiar with current ripples on the ocean bottom, it is doubtful if he could have distinguished them from wave-formed ripples by examining the impressions in the tallow of a hand lead.

However, recent photographs of the bottom of the Pacific Ocean, taken at depths of several thousand feet, show ripple marks. They appear to be mostly current ripples, but there has been a suggestion that a few are symmetrical in cross-section. If so, they are caused by some kind of internal wave rather than surface waves. But, like wind-formed ripples, these must be extremely rare in indurated sediments, so are of little importance to the field geologist.

Ripple Mark Characteristics

The concern of the geologist in the field is to distinguish current-formed ripple marks from those that are wave-formed and, if current-formed, to tell whether they were made by land streams or by currents in an ocean or lake. A few discriminating characteristics have long been known but a recent paper by Evans[4] gives a number of additional ones.

It is necessary to look farther than symmetry in attempting to tell wave-formed from current-formed ripples. In wave-formed ripples, because wave movements are relatively uniform in their action, the longitudinal axes tend to be uniform and parallel for long distances and the curves are gentle. They sometimes divide, and two may unite, but when that happens the crests immediately become parallel again. In current-formed ripples, the longitudinal axes have much less regularity and parallelism, and there are many sharp angular turns, because in streams the current varies widely from place to place. A few minutes observation of the bottom of a stream will show that in some places the sand grains are being pushed rapidly forward in the swift current, while in other places they may be moving very slowly or not at all. These differences in regularity alone may serve to tell the current-formed from the wave-formed ripples, but certain precautions must be observed, especially if there are only a few exposures. In shallow water of varying depth, such

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as is often found along lake shores, both wave size and wave direction may change quickly and result in great variation in the size and direction of the ripples. Again, in deep water, ripples formed by large waves may remain almost undisturbed for long periods of time while the smaller waves pass over without much effect. But, under such conditions, the ripples do gradually disintegrate and become irregular in form, so when found preserved in rock they may be mistaken for current ripples.

Another difficult problem is to discriminate between ripples formed by a bottom current in a body of water and those produced by a land stream. This is impossible from shape alone, but it can sometimes be done if the difference in behavior between a land stream and one in a water body is kept in mind. A land stream has many curves, and these curves migrate downstream. So, in a meandering river, the water at any one place may flow, over a period of years, toward almost every point of the compass. Flat Rock Creek, a little north of Tulsa, furnishes an excellent example. This stream is now cutting down into the bed of an old Pennsylvanian river that was much like some of the present-day Oklahoma rivers and the ripple marks of that old stream are preserved in the thin sandstones that are now being eroded by Flat Rock Creek. They not only change direction widely between upper and lower layers of sandstone but also change widely in the same layer.

A current flowing over the bottom of a body of water is not subject to such frequent changes in direction, and its curves do not migrate like those of a land stream. Also, on the bottom of a lake or ocean, wave-formed ripples will probably have formed nearby. But, as usual, a little caution is necessary here, as sometimes wave-formed ripples form in the quiet stretches of large rivers, though they are rarely preserved in consolidated rocks.

Another characteristic that may serve to distinguish current-formed from wave-formed ripples is difference in uniformity of height. Wave-formed ripples tend to have about the same height throughout their length, but current-formed ripples change in height rapidly along their crests because of the irregularities of stream flow.

Although symmetry or the lack of it does not furnish sufficient evidence for distinguishing between wave-formed and current-formed ripples, certain variations in shape of cross-section do furnish positive evidence as to the origin of the ripple mark. In a stream, if the velocity of the water is such that the ripple marks are traveling visibly downstream, their crests will be sharp, while asymmetrical wave-formed ripples are always rounded as in Figure 1. Also, there is a modified wave-formed ripple mark that, though it may be asymmetrical, is never current-formed. It is the result of waves of smaller size overriding large ripple marks and causing small ridges to form on either the front or back slopes (Figure 2).

Once formed, ripple marks are fairly stable. Of course, a set of ripples produced by small waves will be rather quickly destroyed and replaced by a series of larger waves, but if the new waves are smaller, the old ripples may remain almost unmodified for many hours.

About the Author

PROF. OREN F. EVANS, professor emeritus of geology at the University of Oklahoma, has devoted many years in research work on marine sedimentation and shore processes. The oil industry's expanding activities and interest in the continental shelf make this work of paramount importance today. He was born at Shelby, Mich., and received a bachelor's degree from Albion College and his master's and doctor's degrees from the University of Michigan. He taught mathematics and physics in Albion College for two years and went to the University of Oklahoma in 1920. Since retirement in 1948 he has been retained on half time for research and to teach a course for graduate students on the subject of shorelines and shore processes. He has published numerous articles on the subject in the *Journal of Geology, Journal of Sedimentary Petrology, Science, American Journal of Science,* and *Scientific Monthly* and other publications.

Probably every American geologist is familiar with the use of ripple marks in finding whether sedimentary rocks have been overturned. In doing this, of course, the mold and cast of the ripple must be unlike. Thus asymmetrical ripples with rounded crests are not suitable, since the mold and cast have the same form. But if a secondary ridge is present as in Figure 2, the evidence is conclusive since no ripples ever form with depressions in their sides. Another form that has a distinctive cast is that shown in Figure 3. It shows the cross-section of a wave-formed ripple that is common when large waves have been followed for some time by smaller ones. The small ridges in the bottom are the result of the lesser oscillations produced by the smaller waves. The cast of this, when found on the upper surface of the rock, is certain evidence of overturning. It was formerly held that the typical, sharp crested ripple marks characteristic of deep water would furnish definite evidence of rock sequence. But a ripple mark exactly the reverse of it (Figure 4) often is found in a narrow belt near shore, though it is so rarely preserved that this form still furnishes good evidence of overturning, even though it is not absolute proof.

Undulations of large size sometimes called "giant" ripple marks occasionally occur in sandstone and detrital limestone. They may be either symmetrical or asymmetrical in cross-section, from a few inches to 2 or 3 feet in height and from around 3 feet to 30 feet wide. They are believed to be formed by tidal currents so their presence indicates a marine environment.

Because of the great number of ripple mark forms and the complex relationships under which they occur, the observer must be very cautious in drawing conclusions. A certain amount of training of the eye is necessary before the work can be done with confidence. A few days along the shores and streams observing present day ripple marks will be time well spent.

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TABLE 1

Ten Basic Safety Requirements

1. Full support of management
2. Well defined responsibilities for all parts of an organization
3. Complete system of accident reports and analyses
4. Adequate first aid and medical facilities
5. Publicity to create and maintain interest in safety
6. Proper job training with emphasis on safety
7. Proper protective clothing
8. Use of all possible safeguards and safety measures
9. A program of good housekeeping enforcement
10. Cooperate with outside agencies who can assist in safety program

Safety posters such as this have been distributed to geophysical operators.

A Challenge to the Geophysical Industry

Special SEG Safety Committee sets out to encourage operators to join effort which will benefit all concerned.

By BART W. SORGE

United Geophysical Company, Inc., Pasadena, Calif.
Chairman, SEG Committee on Safety

THE GEOPHYSICAL industry, if it so chooses, can equal the remarkable improvements in safety and accident prevention that several other industrial groups have achieved. The aims of the Society of Exploration Geophysicists' special committee on safety are to encourage all operators of geophysical survey parties to join a concerted effort towards greater safety which will benefit all concerned.

At least five people were killed during 1951 in oil exploration activities in the U. S. The actual number of people killed during the year may be as large as ten, due to the fact that less than one half of the industry reports its accidents to the recognized safety agencies—the American Petroleum Institute, Bureau of Mines, and National Safety Council. The majority of the workers who lost their lives need not have been killed had elementary safety precautions been observed. These recorded deaths represent a 150 percent increase in fatalities over 1950. It appears still to be true that whenever an industry expands rapidly its safety record suffers. Figure 1 shows this trend for geophysical exploration. Figures on the number of geophysical crews in the U. S. were obtained from the annual report of the Committee on Geophysical Activities of the SEG.

Many industrial groups have made remarkable progress improving safety and accident prevention records as the result of industry-wide concerted effort. Some of these industries have work conditions that are at least equal to or more dangerous than in geophysical exploration.

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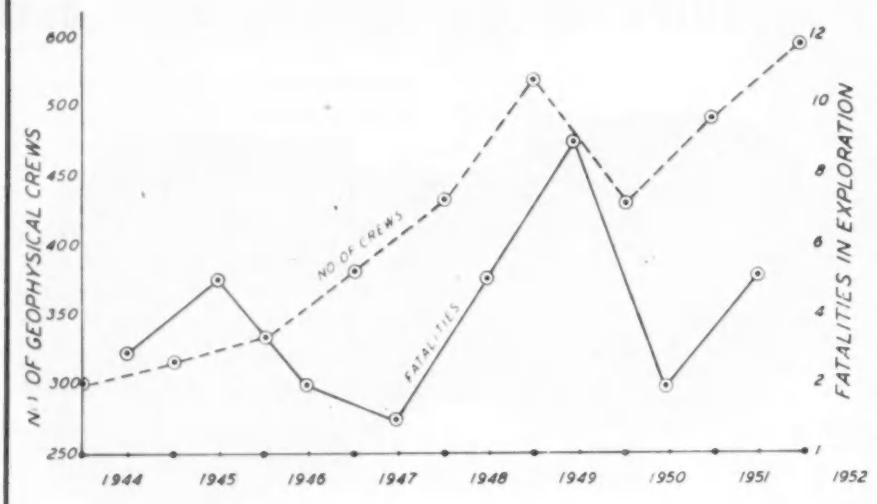

FIGURE 1. Fatalities in oil exploration.

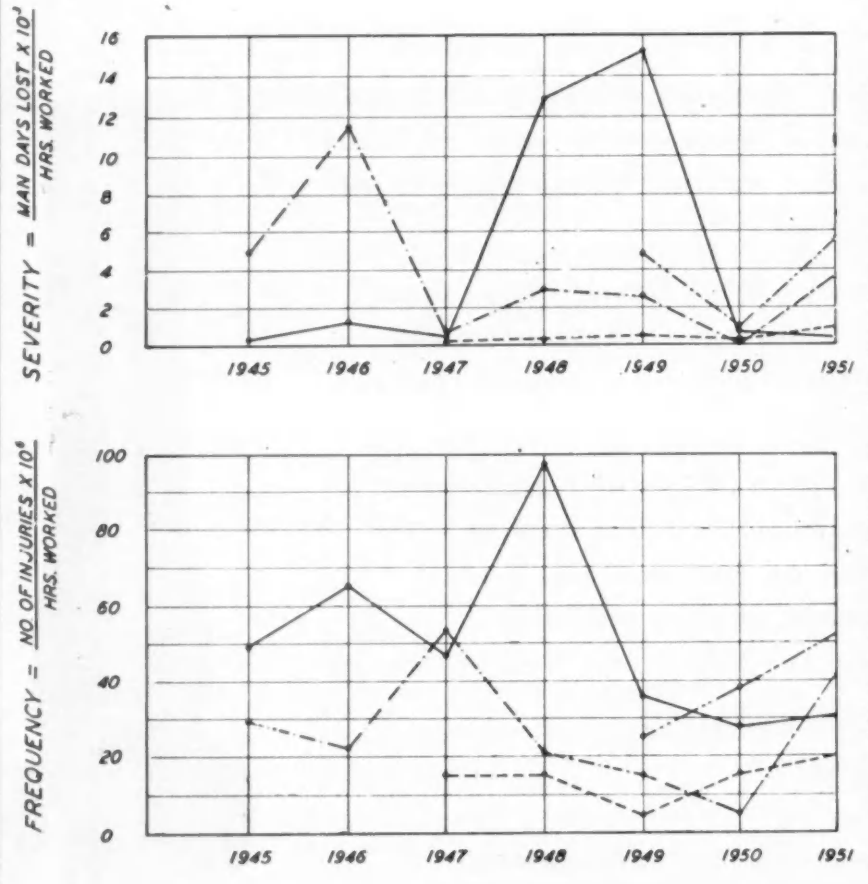

FIGURE 2. Accident frequency and severity rates.

Association and reduced accident experience by 80 percent. This progress is outstanding, as 142 industrial organizations, with an average of several hundred employes each, are involved. When one considers that their operations include drilling, blasting, transporting large volumes of big rocks, crushing them, firing the resulting mixture in large furnaces and other dangerous operations, an 80 percent reduction in accidents speaks for a job well done.

One item that stands out in particular, is that the organizations in the cement industry who have not and are not now cooperating with this industry-wide safety program have a safety record that is from five to 11 times worse than that of the cooperating companies.

Record Cited

Another industrial group that has achieved an outstanding record is the Pacific Coast Association of Pulp and Paper Manufacturers. This group consists of about 35 organizations in the states of Washington, Oregon and California. They started an intensive cooperative safety effort in 1945, and since then have succeeded in lowering the number of lost-time injuries by approximately 77 percent. It is of interest that within this group the smaller organizations have a higher rate of accidents than the larger ones. This is true in almost all industrial groups.

An industrial group that started a safety program in 1945 is the American Association of Oil Well Drilling Contractors. To be sure, not all of the operators cooperated immediately in the safety effort. In the beginning, not even all the members of the association considered the safety and accident prevention effort worthwhile. However, now that the value of a concerted and cooperative safety program has been proven, there are very few drilling operators who are not extremely safety conscious. This group's effort has resulted in a 50 to 60 percent reduction in insurance costs. It is estimated that this represents an annual saving in Texas alone in excess of $2.5 million.

Hardships Lessened

Of course, it is a mistake to emphasize only the financial or material benefits that result from an intelligent and cooperative safety effort. A much more important result, particularly to the employes, is the decrease in the amount of suffering and hardships imposed upon the workers and

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their families as a result of on-the-job injuries and accidents.

In relation to the just-mentioned industrial groups, consider the geophysical exploration industry. At the present time there are approximately 125 geophysical operators in the U. S. Among them are many small contractors with one or two survey crews, several larger contractors operating more than 30 geophysical crews, and many oil companies which operate their own geophysical survey parties. It is generally true that the oil companies operating their own exploration crews are very safety conscious and are presently cooperating with the safety agencies. Among the geophysical contractors this is not the case. The larger contractors, for the most part, have accident prevention programs that are carried out more or less successfully. However, among the other operators are many who need to be shown that worthwhile results can be obtained from a planned safety program. This is necessary so that the industry's safety efforts can be carried out on a wider basis.

Only 14 companies report their accident experiences to the exploration group of the petroleum section of the National Safety Council. Only 65 operators have sent statistical accident information to the API, and about 67 companies have furnished this same information to the Bureau of Mines. This represents a considerable improvement over that of a year ago and, as such, is an accomplishment on the part of the Safety Committee during its first year of activity.

Figure 2 shows the accident experience of several major geophysical operators. The company whose experience is shown by the dashed and dotted lines instituted a safety program during 1946. It can be noted that this company's performance, safetywise, improved almost immediately. Another company whose accident experience is indicated by the solid lines started a safety program in 1949. Here, too, a marked reduction in the number and severity of the accidents resulted. This information proves that a well planned and properly supported safety and accident prevention program will produce results. The rewards, as a result of the safety effort, are in the form of reduced insurance premiums and lower operating costs to the employer, and less loss of income, decrease in hardships, and longer, healthier lives to employes. Since it is known that these benefits can be obtained, it remains, then, to make the facts available to all geophysical operators.

Can't Be Bought

Safety cannot be purchased. In some instances when an operator is faced by an ultimatum from his insurance carrier to improve his safety record, the tendency is to hire a safety engineer and assume that this will solve all of the problems. The setting up of a safety program and the hiring of a safety engineer will solve absolutely nothing unless the basic concept of the responsibility of management changes within the organization involved. The responsible individuals must realize that safe operations are their responsibility and not someone else's. Only in this way will the rest of their organization, down to the helper out in the field, take the safety effort seriously. Without this, it is impossible to produce satisfactory results.

Harry H. Hillman, of the California Production Service, Inc., in a recent paper at the national meeting of the SEG in Los Angeles, likened a well planned safety program and its related activities, including the safety engineer, to a handrail on a winding staircase. Management is located at the top of this staircase, and the workers out in the field at the bottom. In order to succeed, it is necessary to descend this stairway safely from top to bottom. Along the stairway are located the various other parts of the organization in the chain of command, from management to the fellows out in the field. It is imperative that the will to do better must be passed on down the stairway, step by step, from the management, to supervisor, to party chiefs, and finally to the workers in the field. If a slip occurs any place along the way, the safety efforts are bound to fail. Possibly some operators might succeed in skipping down this winding stairway without the handrail, which represents an organized and planned safety program, but the majority will find the handrail necessary, as well as extremely useful, to assure successful and safe arrival at the foot of the stairway. The importance of the determination of the responsible people of an organization to want safer operations cannot be over emphasized. It is the most important qualification necessary for a successful safety and

TABLE 2

Description of Accident

EMPLOYEE CLASSIFICATION	Handling Equipment	Strains and Sprains	Falls or Jumps	Falls On Level	Hand Tools	Explosives	Particles in Eyes	Burns	Traffic	Poison Oak	Miscellaneous	Number of Injuries	Days Lost
Drillers	35	13	4	7	2	1	5	3	1	1	4	76	114
Lost Time Injuries	16	5	0	4	0	0	0	1	1	1	0	28	
Observers	8	5	4	1	0	0	2	0	1	0	6	27	58
Lost Time Injuries	2	4	1	1	0	0	0	0	0	0	4	12	
Shooters	2	3	1	1	1	2	1	0	2	0	0	13	91
Lost Time Injuries	0	2	1	0	0	2	0	0	1	0	0	6	
Surveyors	2	1	2	2	0	0	2	0	2	1	4	16	28
Lost Time Injuries	0	0	2	2	0	0	0	0	2	0	0	6	
Miscellaneous	0	0	1	1	0	0	5	0	4	1	3	15	11
Lost Time Injuries	0	0	0	0	0	0	0	0	3	0	0	3	
No. Injuries	47	22	12	12	3	3	15	3	10	3	17	147	
Lost Time Injuries	18	11	4	7	0	2	0	1	7	1	4		
Days Lost	88	21	17	11	0	18	0	3	100	7	37		302

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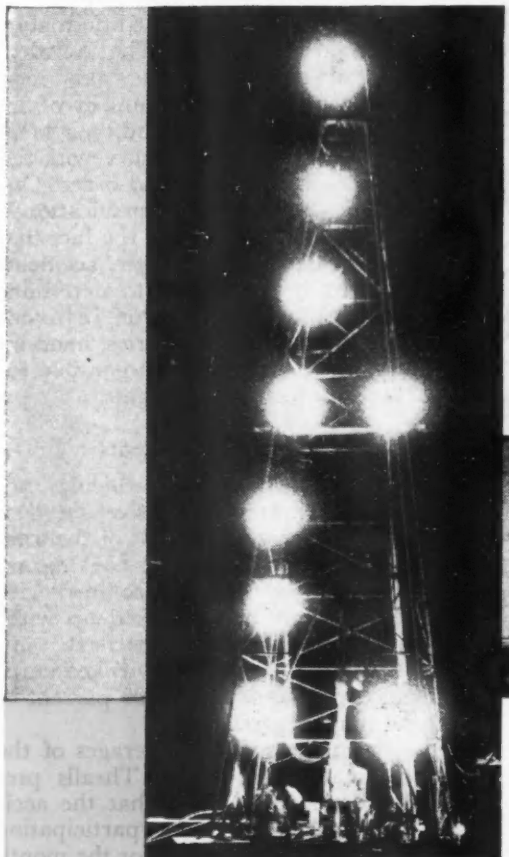

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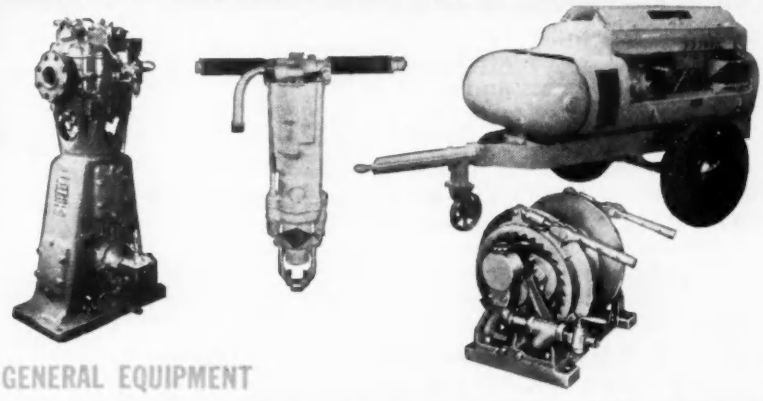

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accident prevention program. Table 1 shows the ten basic requirements for an effective safety program.

The complete system of accident reports and analyses is the one that the SEG safety committee is concerned with at the present time. Early this year API was given the names of geophysical operators. Approximately 100 of these had not previously been sent requests for information. As a result of questionnaires sent out, 50 percent of the operators returned the questionnaire with information, but, unfortunately, only one-half of these returned the information in a form which was usable to be included in the statistics to represent a yardstick indicating the safety performance of the geophysical industry.

This may be due to the fact that many geophysical organizations do not keep adequate safety and accident statistics. As a result, they do not know whether they are making progress, safetywise, or are losing their shirts due to personnel as well as equipment accidents. It will be the committee's task between now and the end of the year to find out from the API wherein the information was incomplete and then help those who filed the incomplete information to overcome the difficulty. It does not require much time or effort to start and maintain an efficient accident record system. A typist or clerk can take care of this matter on a part-time basis in the average organization.

Time Well Spent

The keeping of complete accident reports may appear a waste of time and effort. This however, is an illusion, as has been shown by past experience. A complete system of accident recording and analyses is an invaluable tool which tells an organization how it is doing safetywise. It is also an aid in the planning of a well coordinated safety program. It is important to know what work hazards are responsible for most accidents so that these conditions may be attacked and eliminated, thereby improving the safety performance.

Consider a recent case. An analysis of several accidents revealed one individual was involved in all the accidents. This was not apparent at first, since he was not the injured in all cases. However, it was found that as driller it was his actions that injured his helpers while they were at work following his orders. A session with the party chief and this driller has straightened out the difficulty, as there have been no repetitions for several months. Without a system of accident reports and analyses this would never have been possible.

Drillers Hardest Hit

An analysis of accident experience has been prepared. Table 2 shows that the largest number of injuries happen to drillers and their helpers. This group is responsible, also, for the largest number of days lost as a result of on-the-job injuries. Among the types of accidents, traffic accidents during the period examined have resulted in the largest number of days lost. The handling of mechanical equipment, mostly mounted on trucks, ranks next. In this classification, the drillers and their helpers have the largest number of accidents as well as the most days lost. From this analysis it is evident that the main problem will be to educate the drillers and their helpers to work more carefully and all of the field party personnel to drive company equipment with more caution. By improvements in equipment and work methods we must strive to reduce the accident producing work hazards in our operations.

About a year ago five geophysical companies began, on a voluntary, anonymous basis, a geophysical accident information exchange. The number of participants is now over 20, representing approximately 400 crews. As a result, valuable information is exchanged. An analysis of this information by each participant provides a valuable tool which indicates the work conditions that are responsible for the majority of accidents. It is thus possible for a participant to eliminate those accidents causing work hazards from his own operations before accidents occur. At the national meeting of the SEG, H. M. Thralls, of Seismograph Service Corporation, Tulsa, Okla., presented an analysis of the information exchanged during 1951.

Table 3 summarizes the information presented by Thralls. The Accident Information Exchange also indicates that the largest number of injuries occur to drillers and their helpers, with the recorders, surveyors and shooters following in that order. One reason why the other classification is as large as it is, is due to the fact that in the case of many of the accidents reported it is difficult to determine the classification of the injured. Among the types of injuries, hand injuries rate first, being responsible for 21 percent of the accidents.

TABLE 3

Geophysical Accident Information Exchange
Personal Injuries

Total Injuries	**497**
Hand Injuries	102—21%
Strains	70—14%
Eye Injuries	46— 9%
Collision and Upset	43— 8%
Falls	33— 7%
Moving Vehicles	29— 6%
Sharp Instruments	26— 5%
Falling Objects	25— 5%
Poison Ivy	24— 5%
Cables and Power Reels	18— 4%
Infections	17— 3%
Miscellaneous	63—13%
Dynamite and Caps	1— .2%
Lost Time Injuries	**153**
Drillers	184—37%
Recorders	77—15%
Surveyors	58—12%
Shooters	51—10%
Others	127—26%

TABLE 4

Geophysical Accident Information Exchange
Vehicular Accidents

Number of Accidents	**133**
Excessive Speed	39—30%
Backing	28—21%
Intersection	17—13%
Following Too Closely	11— 8%
Equipment Failure	8— 6%
Passing	5— 4%
Improper Parking	3— 2%
Miscellaneous	21—16%
Wrecked Units	**42**
Survey Truck	10
Water Truck	9
Shooting Truck	5
Drill Truck	3
Recording Truck	3
Miscellaneous	12

Vehicular Accidents

Table 4 shows the vehicular accidents reported. Excessive speed is responsible for 30 percent of the total vehicular accidents, and backing accidents, where vehicles collided with objects while being backed up without proper caution, were next, with 21 percent. Among the wrecked units, survey trucks represent 25 percent of the number wrecked.

From the monthly averages of the information submitted, Thralls predicted ahead of time what the accident experience of the participating organizations would be for the month of January. The results of this prediction pertaining to personal injury accidents are shown in Table 5. Considering the close correlation between the predicted and observed, it is remarkable how uniform human behavior becomes, even as it pertains to accidents when a broad enough base for an average is established.

The results, vehicularwise, are shown in Table 6. The correlation between predicted and observed statistics during the month of January is surprising. It is this predictability that enhances the value of the Geophysical Accident Information Exchange to the participants, as it enables them to eliminate work hazards before accidents happen.

Since April, 1952, the Safety Com-

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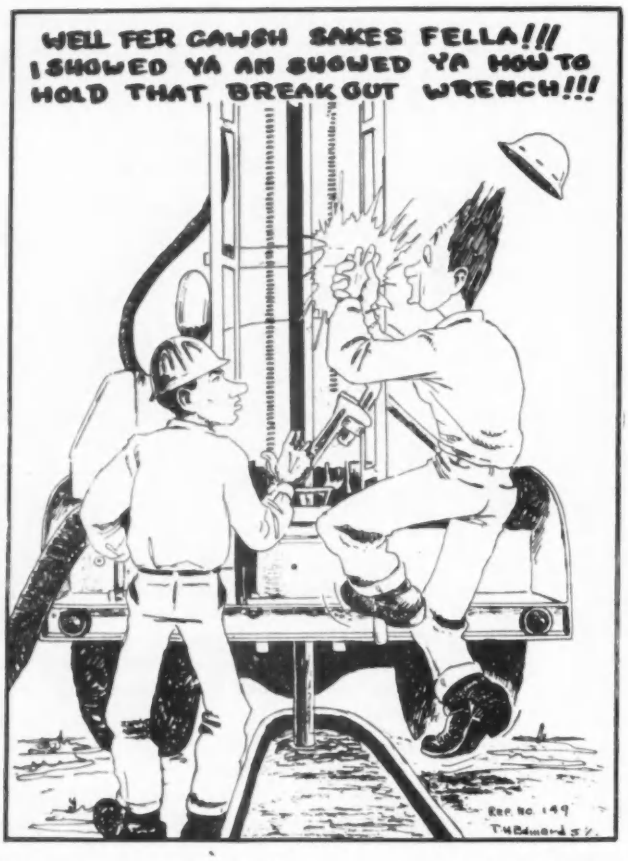

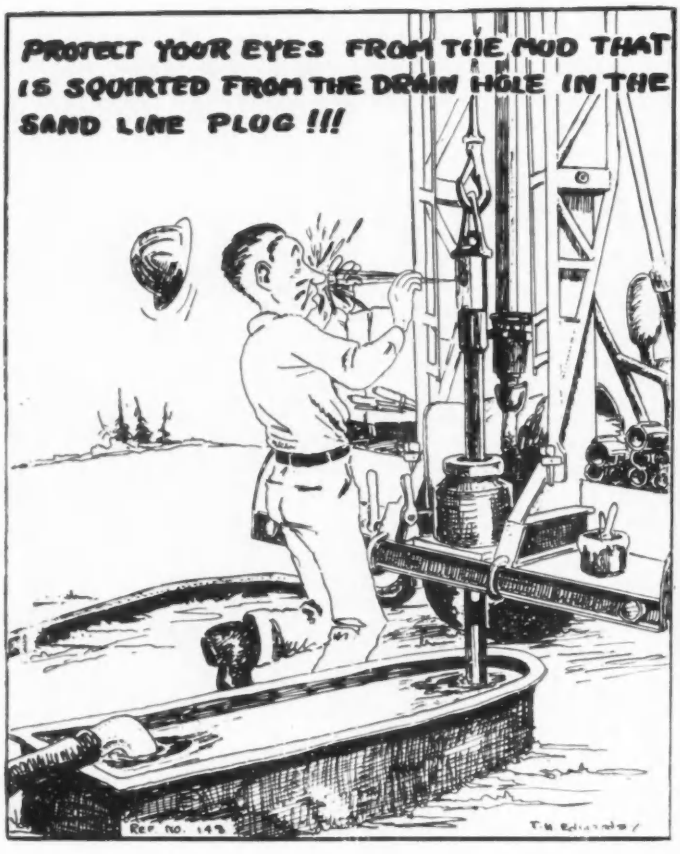

Safety posters are being distributed on a non-profit basis through the Tulsa office of the SEG. Approximately 10,000 of these posters have been sold to various geophysical operators.

mittee of the SEG has received permission from the majority of the participants in the Geophysical Accident Information Exchange to analyze this information at regular intervals and make it available to the industry. It is planned to call attention to those work conditions which are responsible for the largest number of accidents by means of safety posters and bulletins. By doing this, we feel that it will help improve the safety record and stimulate an interest in safety and accident prevention of those organizations that are not now much concerned about this problem.

Also among the basic requirements for an efficient accident prevention program is the publicity to create and maintain an interest in safety. The Safety Committee of the SEG has gathered safety posters, mostly drawn by workers in the industry. These safety posters are being distributed on a non-profit basis through the Tulsa business office of the SEG. Approximately 10,000 of these posters have been sold to various geophysical operators. The committee is to make available additional posters.

Other industrial groups have shown what can be done by cooperative safety effort. Their experience has indicated that an enormous amount of money can be saved, which in these days of ever-increasing operating costs should certainly be welcomed by most organizations. The direct savings resulting from a well coordinated and supported accident prevention program are not only due to reduced insurance premiums, but also due to more efficient operations and lower equipment upkeep expense as a result of more careful handling by the personnel. Lower indirect accident costs, which are usually three to four times the amount of the direct expense, will also result. The Safety Committee of the SEG will continue its endeavor to interest the industry in helping itself because the members, as individuals, have found that it pays to be concerned about safety and that there is no substitute for intelligent accident prevention planning.

TABLE 5

Accident Exchange
January, 1952, Accidents
Total 67

	Predicted	Observed
Lost Time	21	20
Fatalities	0	1
Drill	25	31
Recording	10	12
Survey	8	8
Shooting	7	4
Others	17	12
	Predicted	**Observed**
Hand Injuries	14	11
Strains	9	8
Eye Injuries	6	8
Collision and Upset	6	3
Falls	5	5
Moving Vehicles	4	2
Sharp Instruments	3	3
Falling Objects	3	6
Poison Ivy	3	3
Cables and Power Reels	3	3
Infection	2	2
Miscellaneous	9	13
Dynamite and Caps	0	0

TABLE 6

Accident Exchange
January, 1952, Collision or Upsets
Total—23 Collisions—6 Wrecked Units

	Predicted	Observed
Excessive Speed	7	5
Backing	5	3
Intersection	3	2
Improper Interval	2	2
Equipment Failures	1	1
Passing	1	1
Improper Parking	0	0
Miscellaneous	4	9
Dynamite and Caps	0	0
WRECKED UNITS		
	Predicted	**Observed**
Survey	1.4	1
Water	1.3	2
Shooting	.8	0
Drill	.4	2
Records	.4	0
Others	1.7	1

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Exploratory Drilling Eases During August

By CECIL W. SMITH
WORLD OIL Staff

AFTER REACHING a peak for the year during July, exploratory drilling in the U. S. eased slightly during August, resulting in a few less completed wells. However, the month's activity took second place in the year's operations, and accounted for a few more successful exploratory wells than did July's record efforts.

As a result of this high rate of exploratory drilling, the year's activity holds a 5.7 percent lead over what had been accomplished last year by the end of August. But this lead is being narrowed. At the end of July, the year's exploratory drilling campaign was enjoying a 7.6 percent advantage, but that was dropped to 5.7 percent during August. Later months will see a further narrowing of this margin, as the pipe shortage effects begin to really become evident.

A total of 959 exploratory tests were completed during August, and they were second in number only to the previous month's 978 wells. However, they were substantially behind the 1031 credited to August of last year.

Resulting from the month's activities were 167 successful tests, and they amounted to 17.4 percent of the total drilled. A month earlier, 165 successful operations could account for only 15.9 percent. Both of those months' results failed to match the average of 18.5 percent successful for the year.

Included in August's exploratory successes were 108 new oil pools.

Summary of Results of Exploratory Drilling

ITEM	Aug., 1952	July, 1952	EIGHT MONTHS January-August 1952	EIGHT MONTHS January-August 1951	Percent Dif.
Oil Discoveries	108	114	865	867	— 0.2
New Fields	87	97	663	641	+ 3.4
New Pays	21	17	202	226	— 10.6
Distillate Discoveries	13	11	91	56	+ 62.5
New Fields	11	10	80	38	+110.5
New Pays	2	1	11	18	— 38.9
Gas Discoveries	17	13	131	139	— 5.8
New Fields	13	12	104	111	— 6.3
New Pays	4	1	27	28	— 3.6
Total Discoveries	138	138	1,087	1,062	+ 2.4
Extensions to Fields	29	27	243	194	+ 25.3
Oil Fields	28	25	206	153	+ 34.6
Distillate Fields			6	12	— 50.0
Gas Fields	1	2	31	29	+ 6.9
Total Prod. Tests	167	165	1,330	1,256	+ 5.9
Dry Holes	792	813	5,854	5,543	+ 5.6
Wildcats	787	804	5,650	5,276	+ 7.1
New Pays			11	10	+ 10.0
Outposts	5	9	193	257	— 24.9
Total Expl'tory Tests	959	978	7,184	6,799	+ 5.7
Percent Productive	17.4	16.9	18.5	18.5	.....
Percent Dry	82.6	83.1	81.5	81.5	.....

Results of Exploratory Drilling in August and First 8 Months, 1952-1951, by Districts

State or District	MONTH OF AUGUST, 1952													FIRST EIGHT MONTHS, 1952																
	Productive Tests										Unproductive Tests				Productive Tests								Total Productive		Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions			Total Productive				Total Exploratory Tests	New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	8 Mo. 1952	8 Mo. 1951	Wildcats	New Pays	Outposts	8 Mo. 1952	8 Mo. 1951	8 Mo. 1952	8 Mo. 1951
Alabama											3			3	1		1							2	3	24			24	10	26	13
Arizona																										1			1	1	2
Arkansas	2									2	13			15	9			1			2	1		13	14	63		1	64	63	77	77
California	4	1	1	2			3			11	39		1	51	22	1	5	18			21		2	69	44	234	2	24	260	321	329	365
Colorado	2								1	3	31			34	9	1	3	3			2	2		1	21	8	127		2	129	68	150	76
Florida																										6			6	3	6	3
Idaho																														1		1
Illinois	2			2		2	8			14	76			90	15			13		2	35			65	63	387			387	462	452	525
Indiana	3						1			4	32			36	13			2			10			25	33	232		2	234	233	259	266
Kansas	7									7	73			80	79	1	7	7			1			95	134	581			581	533	676	667
Kentucky	4									4	13			17	19			1			4			24	24	82			82	122	106	146
Louisiana	3	5		2						10	37			47	25	21	3	12	3		2		2	68	65	233	1	3	237	227	305	292
North Louisiana				2						2	25			27	8	4	3	8	3		1		1	28	29	125		3	128	146	156	175
South Louisiana	3	5								8	12			20	17	17		4			1		1	40	36	108	1		109	81	149	117
Michigan	2									2	17			19	14		1	5		3	4		1	28	14	159			159	201	187	215
Mississippi											17			17	8	2		2			1	2		15	11	109		3	112	93	127	104
Missouri																										14			14		14	
Montana											12			12	2		1				2			5	5	39		2	41	35	46	40
Nebraska	2		2							4	22			26	6		2	1			2			11	13	71	1	2	74	45	85	58
Nevada																														2		2
New Mexico	4			1						5	9			14	17	2	9	7	1	3	6			45	25	77	1	1	79	51	124	76
North Dakota	1									1				1	4						5			9	1	4			4	5	13	6
Ohio											3			3				1			2		6	9	5	24			24	16	33	21
Oklahoma	11	1	2	1			6			21	80			101	56	7	10	25		1	32	1	2	134	102	496			496	437	630	539
Pennsylvania																									1	2			2		2	1
South Dakota																										2			2		2	
Tennessee																														6		6
Texas	40	4	8	13	2	2	9			78	290		4	372	360	43	59	101	7	13	72	5	17	677	664	2574	6	151	2731	2510	3408	3174
Dist. 1 S. Central	1									1	29			30	10	2	1	1		1	2		1	18	26	206		6	212	154	230	180
Dist. 2 Middle Gulf	2	3	2							7	26		1	34	18	13	8	5			8	3	8	63	70	179	1	14	194	164	257	234
Dist. 3 Upper Gulf	4		1	6	2	1	2			16	16		2	34	21	13	7	7	4	7	2	2	4	97	69	196		15	211	187	308	256
Dist. 4 L. Gulf-S.W.	2		4	2		1	1			10	19			29	21	9	20	11	2	3	5		3	74	95	263	3	11	277	263	351	358
Dist. 5 E. Central											13			13	3	1								4	17	78		2	80	114	84	131
Dist. 6 Northeast											8			8	5	2	1	7			2			17	16	86		2	88	62	105	78
Dist. 7-B N. Cent.	13		1	1			2			17	62		1	80	114	2	12	4	1	2	4			139	153	625		9	634	642	773	795
Dist. 7-C W. Cent.	6			1						7	24			31	49		3	5			12			69	54	257		3	260	204	329	258
Dist. 8 West	5	1		1			1			8	34			42	43	1	1	15			24		1	85	67	263	1	4	268	264	353	331
Dist 9 North	7			2			3			12	56			68	76		5	16			13			110	92	401	1	81	483	440	593	532
Dist. 10 Panhandle											3			3			1							1	5	20		4	24	16	25	21
Utah							1			1	5			6							1			1	2	32			32	16	33	18
West Virginia															1									1	2	3			3	2	4	4
Wyoming											15			15	3	2	1	5			2			13	23	74		2	76	79	89	102
Total U.S.	87	11	13	21	2	4	28		1	167	787		5	959	663	80	104	202	11	27	206	6	31	1330	1256	5650	11	193	5854	5543	7184	6799

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WHO U. S. Discoveries in August WHERE

ARKANSAS—NEW OIL FIELDS

Calhoun County. B. E. Hill et al's Freeman Smith Land Co. 1, NE SE 14-16s-13w, pumped 75 barrels oil and 20 barrels water from Travis Peak sand, Lower Cretaceous 3462-3470 feet, 18-gravity, completed 8-23-52, TD 3500.

Lafayette County, North Stamps area. McAlester Fuel Co.'s B. L. Williams A-1, SW SE 5-16s-23w, pumped 11 barrels from Tokio sand, Upper Cretaceous 2364-2373 feet, 16-gravity, completed 8-15-52, TD 4020.

CALIFORNIA—NEW OIL FIELDS

Kern County, Mountain View, Southeast field. Patrick A. Doheny's Di Giorgio 1, SW NE 3-31s-29e, pumped 20 barrels from Schist 4842-4921 feet, 3/16-inch, 27-gravity, completed 7-31-52, TD 4922.

Los Angeles County, Newhall-Tunnel area. Atlantic Oil Co.'s Needham 1, SW SE 12-3n-16w, pumped 75 barrels, 19.2-gravity, completed 8-15-52, TD 1609.

Santa Barbara County, Careaga area. Western Gulf Oil Co.'s Careaga 1, NE SE 7-8n-33w, pumped 90 barrels oil and 10 barrels water from 5627-7259 feet, 23.9-gravity, completed 8-4-52, TD 7280.

Ventura County, Oakridge field. Union Oil Co.'s Oakridge 2-10, in 10-3n-18w, flowed 389 barrels from Lucian sand, Miocene 2852-3298 feet, 22/64-inch, 21.5-gravity, completed 8-15-52, TD 3300.

CALIFORNIA—NEW OIL PAYS

Kern County, Cymric field. Intex Oil Co.'s Cymric 34, SE NW 21-29s-21e, flowed 68 barrels from Phacoides sand, Miocene 4754-4794 feet, 7/32-inch, 34.4-gravity, completed 8-5-52, TD 5215.

Lost Hills field. Superior Oil Co.'s Lost Hills Government 1, SW SW NW 18-26s-21e, flowed 125 barrels from Pliocene sand 2886-2967 feet, 9/64-inch, 23.6-gravity, completed 8-16-52, TD 2971.

CALIFORNIA—OIL FIELD EXTENSIONS

Los Angeles County, Santa Fe Springs field. Pray & Walker Gauldin Comm. 1, Old Well Drilled Deeper, in 5-3s-11w, southeast extension, flowed 504 barrels from 7375-7500 feet, 5/16-inch, 32.5-gravity, completed 8-11-52, TD 8200.

Ventura County, Shiells Canyon field. Harry C. Long, Operator's Basolo 2-5, NW NW 5-3n-19w, northwest extension, pumped 125 barrels from Sespe sand, Oligocene 3490-3590 feet, 27.5 gravity, completed 8-22-52, TD 3854.

Ventura County, South Mountain field. Los Nietos Co.'s Stewart 1, in 24-3n-21w, south extension, pumped 113 barrels oil and 50 barrels water from 5649-5650 feet, completed 8-18-52, TD 5800.

CALIFORNIA—NEW DISTILLATE FIELD

Fresno County, Turk Anticline area. Richfield Oil Corp.'s Denlinger 1, SW NE 14-17s-15e, flowed 400 barrels distillate and 6.3 million from Eocene sand 9219-9331 feet, 25/64-inch, 59-gravity, completed 8-17-52, TD 9970.

CALIFORNIA—NEW GAS FIELD

Sutter County. Richfield Oil Corp.'s Sutter Comm. A-1, SW NW SW 8-15n-2e, flowed 9 million from Cretaceous sand 2065-2145 feet, completed 8-24-52, TD 3104.

COLORADO—NEW OIL FIELDS

Logan County. Shell Oil Co.'s J. Knifton 1, NW NW NW 23-8n-53w, flowed 86 barrels oil and 2 barrels water from Dakota sand, Upper Cretaceous 4785-4794 feet, ¼-inch, completed 8-5-52, TD 5256.

Washington County. Kimbark Co.'s Ward 1, C SE SE SE 3-2s-54w, pumped 35 barrels oil and 90 barrels water from Dakota "J" sand, Upper Cretaceous 4788-4802 feet, completed 6-12-52, TD 4939.

COLORADO—GAS FIELD EXTENSION

La Plata County, Red Mesa area. Southern Union Gas Co.'s Ute 1-B, C NE SW SW 11-32n-11w, 1¼-mile northeast extension, flowed 2 million from Point Lookout sand, Upper Cretaceous 5165-5590 feet, open, completed 8-6-52, TD 5694.

ILLINOIS—NEW OIL FIELDS

Gallatin County, Shawneetown, East field. Ashoff-McGuire-Vandenbark's Logesden

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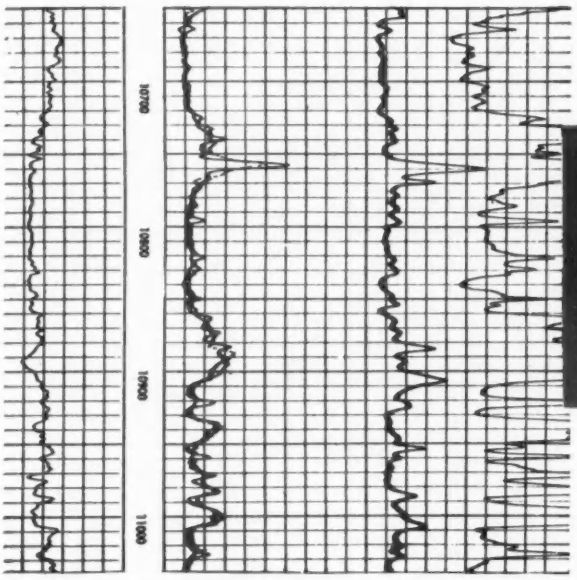
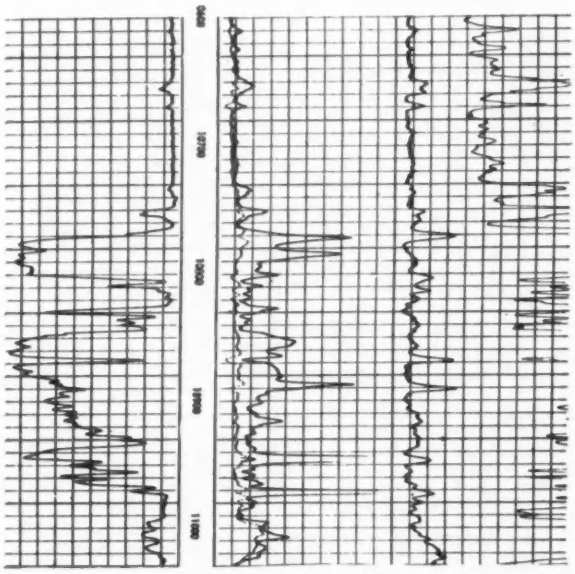


1. Section of Well No. 1, logged with a lime base, oil emulsion system. Log in this mud offers some interpretation and correlation problems.



2. Well No. 2, with paralleling stratigraphic structure, was drilled with a Driscose base oil emulsion system. Observe the improved spontaneous potential curve on the left. Furthermore, no mechanical or gelation problems.

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Portions of electric logs shown at left are further identified and discussed in the June, 1952 WORLD OIL article, "CMC Blended for Improved Resistivity."

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1, NE NW NW 23-9s-10e, pumped 50 barrels from Aux Vases sand, Mississippian 2660-2669 feet, completed 8-26-52, TD 2670.

Wayne County, Rinard, North field. R. C. Halbert's Cisne 1, SW NW 28-2n-7e, pumped 146 barrels from McClosky lime, Mississippian 3126-3130 feet, completed 8-12-52, TD 3189.

ILLINOIS—NEW OIL PAYS

Lawrence County, Ruark, West, Consolidated field. W. Duncan's H. Hardacre 1, SW SE SW 1-2n-13w, pumped 110 barrels oil and 15 barrels water from Cypress sand, Mississippian 2167-2176 feet, completed 8-12-52, TD 2417.

Wayne County, Johnsonville, West field. W. O. Lucas' F. A. Hufines 1, Old Well Worked Over, NE NE NW 13-1n-5e, ¾-mile from production, pumped 11 barrels oil and 1 barrel water from Bethel sand, Mississippian 2927-2934 feet, completed 8-12-52, TD 3100.

ILLINOIS—OIL FIELD EXTENSIONS

Franklin County, Taylor Hill field. E. A. Obering's Webb 1, SW SW SE 9-5s-4e, ¾-mile north extension, pumped 71 barrels from Lower O'Hara lime, Mississippian 3059-3063 feet, completed 8-19-52, TD 3227.

Gallatin County, Inman, West Consolidated field. Calvert Drilling Co.'s J. B. Henderson 1, NW SW NW 27-8s-9e, ¾-mile extension, pumped 30 barrels oil and 2 barrels water from Cypress sand, Mississippian 2474-2504 feet, completed 9-2-52, TD 2511.

Inman, East Consolidated field. Inland Production Co.'s A. A. Pielemeier 1, SW SE NE 28-8s-10e, ½-mile south extension, pumped 55 barrels oil and 50 barrels water from Waltersburg sand, Mississippian 1996-2006 feet, completed 8-12-52, TD 2920.

Hamilton County, Bungay Consolidated field. The Texas Co.'s C. Epperson 1, SE SE SE 3-4s-7e, 1-mile north extension, pumped 9 barrels from McClosky lime, Mississippian 3406-3418 feet, completed 8-19-52, TD 3469.

Richland County, Clay City Consolidated field. Bell Bros.' D. Young 1, SE SE NW 33-5n-10e, ¾-mile extension, pumped 144 barrels from McClosky lime, Mississippian 2905-2911 feet, completed 8-26-52, TD 2915.

Wabash County, Lexington, North field. Hayes Drilling Co.'s A. Ankenbrandt 1, NE NW SE 14-1s-14w, ¾-mile northeast extension, pumped 65 barrels from Lower O'Hara lime, Mississippian 2898-2902 feet, completed 8-12-52, TD 2991.

White County, Carmi field. Deep Rock Oil Co.'s Vaught "A" 1, NW NW SE 24-5s-9e, 1-mile east extension, pumped 16 barrels oil and 38 barrels water from Cypress sand, Mississippian 2796-2809 feet, completed 8-5-52, TD 3255.

Enfield field. Mack Holt's E. Biggerstaff 1, Old Well Worked Over, E½ SE NW 33-5s-8e, 1-mile south extension, pumped 12 barrels oil and 14 barrels water from Aux Vases sand, Mississippian 3306-3319 feet, completed 8-12-52, TD 3494.

ILLINOIS—NEW GAS PAYS

Crawford County, Main field. Skiles Oil Corp.'s R. Hudson P-1, NW NW NW 6-5n-12w, flowed 3 million from Hardinsburg sand, Mississippian 1074-1105 feet, completed 8-12-52, TD 1476.

New Hebron field. Ervin & Bassett's Weirick 1, SE NE NE 29-6n-12w, flowed 0.4 million from Aux Vases sand, Mississippian 1490-1497 feet, completed 8-12-52, TD 1513.

INDIANA—NEW OIL FIELDS

Daviess County. Buell Abney's Cornelius Brothers 2, NE SE SW 6-5n-5w, pumped 25 barrels from Aux Vases lime, Mississippian 551-553 feet, TD 553.

Gibson County. George & Wrather-Aubrey & Tennant's Victor A. Anslinger 1, NW SE NW 13-3s-10w, pumped 85 barrels from O'Hara lime, Mississippian 2025-2029 feet, TD 2150.

Spencer County. Sun Oil's F. O. Varner et al Unit 1, SW SW NE 20-6s-4w, swabbed 30 barrels from Jackson sand, Mississippian 677-690 feet, TD 1028.

INDIANA—OIL FIELD EXTENSION

Gibson County, Patoka, East field. Francis Beard's J. W. Kolb 1, in 21-1s-10w, ½-mile extension, pumped 336 barrels from Aux Vases lime, Mississippian 1818-1825 feet, TD 1825.

KANSAS—NEW OIL FIELDS

Barton County. Petroleum, Inc.'s Tucker A-1, NE NE SE 28-20s-13w, pumped 504 barrels from Lansing lime, Pennsylvanian 3410-3430 feet, TD 3628.

Cowley County, Harvey field. Martin & Cash's Harvey 1, NE NW NW 23-34s-3e, potentialed 2382 barrels from Bartlesville sand, Pennsylvanian 3278-3279 feet, TD 3292.

Ellis County, Pleasant, Northwest field. Imperial Drilling Co.'s Giebler B-1, SE SE SW 27-13s-20w, pumped 304 barrels from Arbuckle lime, Ordovician 3814-3830 feet, TD 3830.

Rice County, Galt field. Birmingham-Bartlett's Ferguson 1, NW SW NE 8-18s-7w, pumped 152 barrels from Arbuckle lime, Ordovician 3193-3197 feet, TD 3200.

Stafford County, Pleasant Grove field. Shelly-Miller Drilling Co.'s Spangenberg 1, SE NE SW 26-22s-12w, pumped 253

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barrels from Lansing lime, Pennsylvanian 3460-3468 feet, TD 3649.

Strobel field. Petroleum, Inc.'s Strobel B-1, CN½ NW SW 9-22s-14w, pumped 100 barrels from Arbuckle lime, Ordovician 3868-3872 feet, TD 3911.

Strobel, Northwest field. Petroleum, Inc.'s Strobel C-1, SE NE NW 8-22s-14w, pumped 94 barrels from Simpson lime, Ordovician 3852-3854 feet, TD 3893.

KENTUCKY—NEW OIL FIELDS

Daviess County. Felmont Oil Co.'s O. H. Parker Min 1, in 22-0-26, pumped 65 barrels from Benoist sand, Mississippian 1992-2002 feet, TD 2002.

Henderson County. Al Morris Drilling Co.'s Wm. H. Sauer 1, in 17-Q-22, pumped 68 barrels from Cypress sand, Mississippian 2217-2223 feet, TD 2223.

Unnamed field. O. L. Sturbois' C. T. Bentley-Sandefur 1, S½ NW 9-Q-22, pumped 4 barrels from Hardinsburg sand, Mississippian 1916-1921 feet, TD 1921.

Logan County. Solon Mitchell's A. Johnson 1, in 8-B-34, flowed 112 barrels from Dutch Creek sand, Mississippian 989-1009 feet, TD 1010.

NORTH LOUISIANA—NEW OIL PAYS

Catahoula Parish, Mitten Lakes field. Hunt Oil Co. et al's Louisiana Delta Hardwood Lumber Co. Inc. 37, C NW SE 27-4n-5e, pumped 8 barrels from Sparta sand, Eocene 3709-3711 feet, 22-gravity, completed 8-13-52, TD 7000.

Saline Lake field. Hunt Oil Co. et al's Louisiana Delta Hardwood Lumber Co. Inc. 59, C SW NW 23-4n-5e, flowed 50 barrels from Sparta sand, Eocene 3594-3598 feet, ¼-inch, 22-gravity, completed 8-14-52, TD 6500.

SOUTH LOUISIANA—NEW OIL FIELDS

Beauregard Parish. Magnolia Petroleum Co.'s Long-Bell E-1, in 10-6s-9w, flowed 78 barrels oil and 26 barrels water from 8590-8594 feet, ⅛-inch, 47.9-gravity, completed 8-20-52, TD 9296.

St. Martin Parish. Humble Oil & Refining Co.'s Mrs. W. H. Crowson et al 1, in 26-10s-9e, flowed 281 barrels from 10,691-10,696 feet, ⅛-inch, 36.7-gravity, completed 8-20-52, TD 13,462.

West Baton Rouge Parish. The Texas Co.'s Baist Cooperage & Lumber Co. Inc. 1, in 97-7s-10e, flowed 324 barrels from 10,155-10,176 feet, 7/32-inch, 36.4-gravity, completed 8-16-52, TD 12,300.

SOUTH LOUISIANA—NEW DISTILLATE FIELDS

Acadia Parish, Northwest Branch area. Sunray Oil Corp.'s Cyprien Fontenot 1, in 80-8s-2e, flowed 89 barrels distillate and 1.3 million from Lower Miocene sand 11,196-11,206 feet, ⅛-inch, 50.1-gravity, completed 8-3-52, TD 12,600.

Calcasieu Parish. Gulf Refining Co.'s Martha De Rouen et al 1, in 15-11s-6w, flowed 60 barrels distillate and 5.3 million from Lower Miocene sand 10,924-10,954 feet, ¼-inch, 43.8-gravity, completed 8-7-52, TD 11,590.

Unnamed field. Sun Oil Co.'s Lutcher-Moore 5, in 2-8s-13w, flowed 145 barrels distillate and 1.5 million from 9015-9030 feet, ⅛-inch, 50.6-gravity, completed 8-11-52, TD 9722.

Lafourche Parish. Hassie Hunt Trust's Joseph Marcello 1, in 59-15s-17e, flowed 51 barrels distillate and 2.5 million from 9580-9586 feet, 3/16-inch, 51.2-gravity, completed 8-4-52, TD 13,760.

Plaquemines Parish, Lake Campo field. William Helis Estate's State Lease 1762-1, flowed 6 barrels distillate and 1.4 million from 9416-9432 feet, ⅛-inch, 47.0-gravity, completed 7-22-52, TD 10,551.

MICHIGAN—NEW OIL FIELDS

Barry County. Henry R. Fothgill's Myers & Myers Comm. 1, SE NE NE 4-4n-10w, Thornapple Township, pumped 1 barrel from Traverse lime, Devonian 1951-1953 feet, TD 1956.

Kent County. James J. McGerry, Trustee & McClure Oil Co.'s Emorey 1, SE NW SE 10-10n-12w, Tyrone Township, pumped 15 barrels oil and 42 barrels water from Traverse lime, Devonian 2376-2380 feet, TD 2383.

NEBRASKA—NEW OIL FIELDS

Chase County. Suhr, Fielder & Lock's Lock 1-A, NE SW NW 7-6n-41w, pumped 5 barrels oil and 30 barrels water from Dakota "J" sand, Cretaceous 2999-3002 feet, TD 3030.

Cheyenne County. British American Oil Producing Co.'s Jacobsen 1, SW SE NW 27-14n-49w, pumped 35 barrels oil and 30 barrels water from Dakota "J" sand, Cretaceous 4745-4748 feet, completed 8-6-52, TD 4800.

NEBRASKA—NEW GAS FIELDS

Cheyenne County. The Chicago Corp. & Republic Natural Gas Co.'s George E. Wood 1, C NW 7-13n-49w, flowed 6.5 million from Dakota "J" sand, Cretaceous 4849-4871 feet, open, completed 8-27-52, TD 5140.

Unnamed field. E. Julian Davis' Olson 1, NE NE SW 17-12n-52w, flowed 0.8

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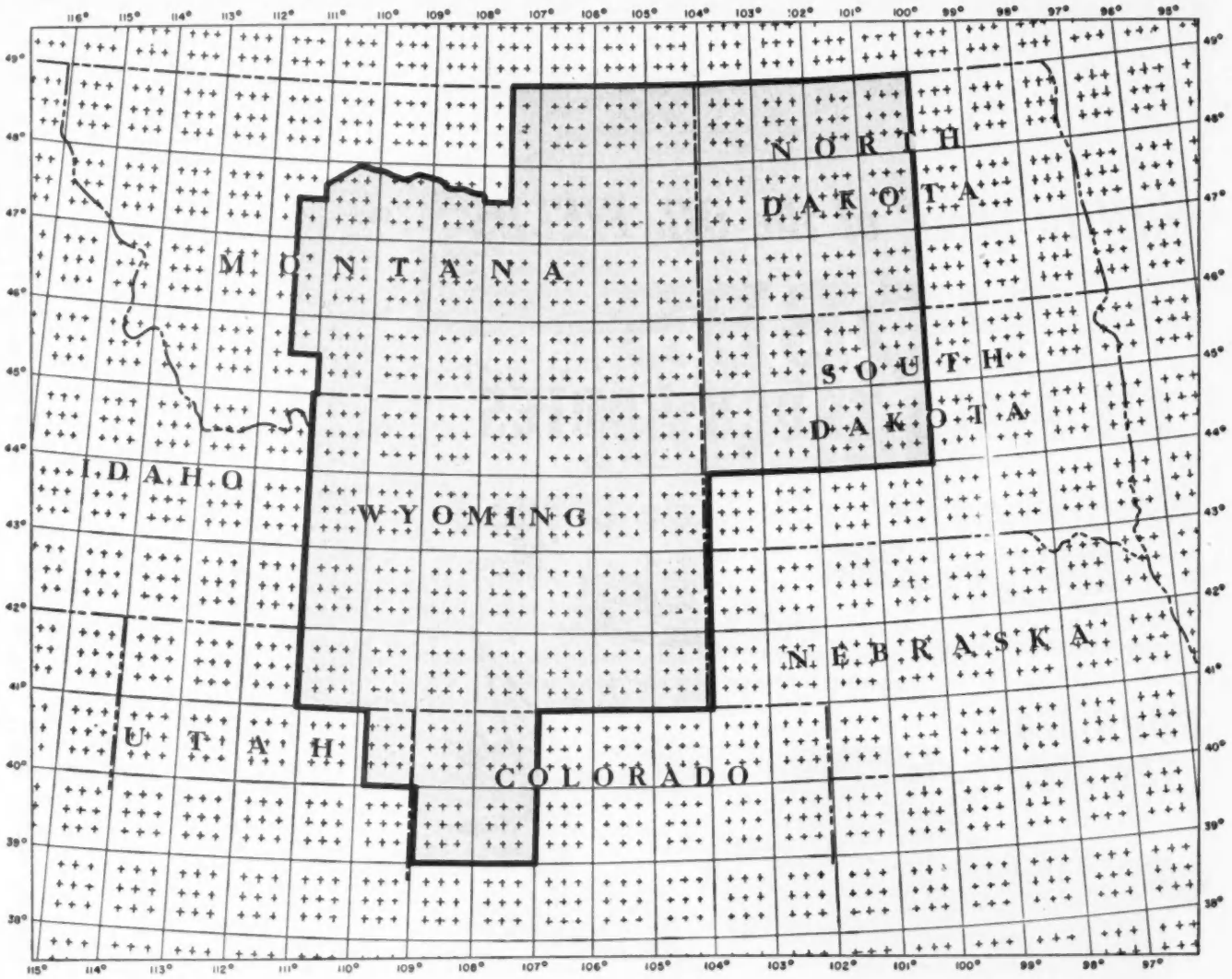

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million from Dakota "J" sand, Cretaceous 5380-5381 feet, 5/16-inch, completed 8-20-52, TD 5435.

NEW MEXICO-PERMIAN BASIN—NEW OIL FIELDS

Eddy County. Allen Hargrave's Humble-State 1, in 21-24s-27e, pumped 17 barrels from Delaware lime, Permian 2300-2308 feet, 43-gravity, completed 8-4-52, TD 2311.

Unnamed field. Buck Jones Drilling Co.'s V. L. Cates-Federal 1, in 29-26s-27e, pumped 20 barrels from Castille lime, Permian 869-885 feet, 22.6-gravity, completed 8-22-52, TD 885.

Unnamed field. Hanson & Yates' Cordie King 1, in 22-23s-26e, pumped 58 barrels oil and 50 barrels water from Delaware sand, Permian 1876-1881 feet, 38-gravity, completed 8-11-52, TD 1881.

Lea County: Tide Water Associated Oil Co.'s H. T. Monteith 1, in 20-16s-37e, flowed 754 barrels from Strawn lime, Pennsylvanian 11,256-11,280 feet, 5/8-inch, 42.2-gravity, completed 8-11-52, TD 11,925.

NEW MEXICO-PERMIAN BASIN—NEW OIL PAY

Lea County, Moore field. The Texas Co.'s State "BN" 1, in 25-11s-32e, ½-mile south of production, flowed 72 barrels from Wolfcamp lime, Permian 9654-9710 feet, 1-inch, 43.9-gravity, completed 8-18-52, TD 10,232.

NORTH DAKOTA—NEW OIL FIELD

McKenzie County. Amerada Petroleum Corp.'s State 1-D, NE NW 16-153n-95w, flowed 127 barrels oil and 131 barrels water from Madison sand, Mississippian 8914-8963 and 8998-9042 feet, ½-inch, 39.8-gravity, completed 8-30-52, TD 9335.

OKLAHOMA—NEW OIL FIELDS

Beaver County, Floris field. Carter Oil Co.'s Hugh W. Dorman 1, C NW NW 29-5n-22ecm, flowed 114 barrels oil and 22 barrels water from Upper Marmaton lime, Pennsylvanian 5590-5592 feet, 3/16-inch, 39.4-gravity, completed 8-52, TD 7100.

Garfield County. Goe Drilling et al's Wells 1, NE SE SW 22-22n-4w, pumped 25 barrels oil and 30 barrels water from Belveal sand 1859-1864 feet, 46.3-gravity, TD 1907.

Lincoln County, Chandler field. Midwest Oil Co.'s Lockhart 1, NE NE SE 17-14n-4e, southeast extension, flowed 115 barrels from First Wilcox sand, Ordovician 4926-4934 feet, 40-gravity, TD 4934.

Happy Hill, West field. A. R. Jordan's Orr 1, NW NE NW 12-13n-2e, flowed 290 barrels from Lower Skinner sand, Pennsylvanian 4592-4601 feet, 7/64-inch, 42-gravity, TD 4623.

Noble County, Marathon, Northwest field. Darby and Bothwell's Bernice Evans 1, SW SW SE 11-22n-2e, pumped 58 barrels oil and 15 barrels water from First Wilcox sand, Ordovician 4386-4388 feet, TD 4450.

Okfuskee County, Hilliby, West field. Wilcox Oil Co.'s Tims 1, SW SE SE 28-13n-7e, pumped 50 barrels from Dutcher sand, Pennsylvanian 3654-3660 feet, 29-gravity, TD 4395.

Unnamed field. John B. Quinn's Morgan 1, SE SE SE 24-13n-9e, pumped 75 barrels from Second Dutcher sand, Pennsylvanian 2916-2924 feet, TD 2955.

Unnamed field. Jones-Shelburne's Maloy 1, NW SE NE 3-13n-8e, pumped 6 barrels oil and 10 barrels water from Cromwell sand, Pennsylvanian 3513-3517 feet, TD 3525.

Osage County. Osage Production Co.'s Osage 1, SE SE NE 5-23n-7e, pumped 50 barrels oil and 50 barrels water from Mississippi lime, Mississippian 2740-2744 feet, TD 2748.

Payne County. Feagin Co.'s Arvel Cundiff A-1, NE NW SW 9-17n-1e, pumped 20 barrels oil and 20 barrels water from First Wilcox sand, Ordovician 5110-5111 feet, 44-gravity, TD 5178.

Unnamed field. Fullerton Oil Co.'s Varlin T. Nelson 1, NE SW NE 25-18n-2e, flowed 40 barrels from Lower Skinner sand, Pennsylvanian 4153-4156 feet, ½-inch, 40.6-gravity, TD 4796.

OKLAHOMA—NEW OIL PAY

Logan County. John Kraker's Bliss 1, SW NW NE 26-17n-1e, flowed 105 barrels oil and 15 barrels water from First Wilcox sand, Ordovician 5044-5048 feet, TD 5193.

OKLAHOMA—OIL FIELD EXTENSIONS

Lincoln County, Carney, Northeast field. N. V. Duncan's Emma T. Grasgrin 1, SE SE NE 35-16n-3e, southeast extension, pumped 50 barrels from Red Fork sand, Pennsylvanian 4224-4231 feet, 41-gravity, TD 4376.

Chandler, South field. Culbertson and Vandenover's Marty 1, NW NE SE 22-14n-4e, pumped 50 barrels oil and 100 barrels water from Simpson dolomite, Ordovician 4966-4971 feet, TD 5030.

Davenport field. Garr-Woolley's Rosemary Reynolds 2, NW SW NW 27-14n-

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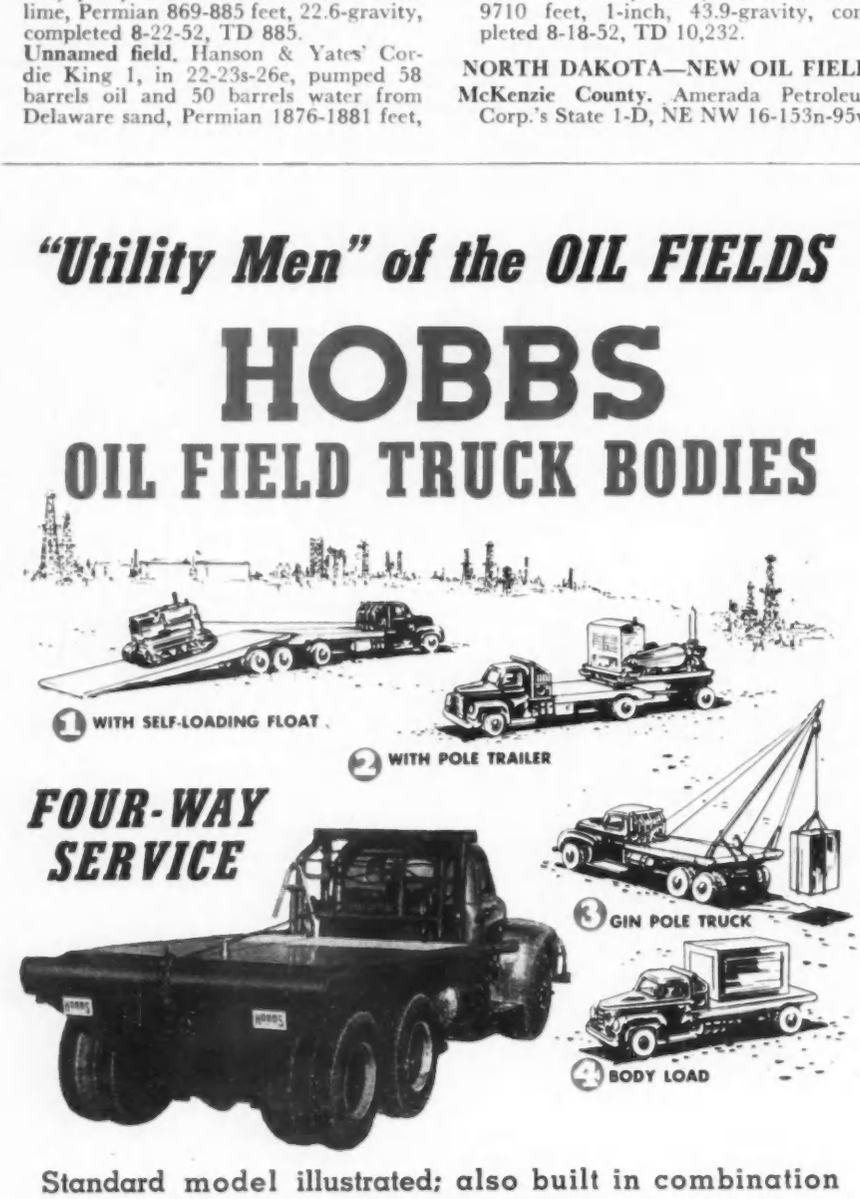

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5e, south extension, flowed 40 barrels from Prue sand, Pennsylvanian 3575-3589 feet, 5/32-inch, TD 3589.

Davenport, West field. Great Lakes Carbon Corp.'s Ward Bridge 1, SE SE SW 13-14n-4e, west extension, pumped 52 barrels from Red Fork sand, Pennsylvanian 4049-4056 feet, TD 4056.

Payne County, Markham field. L. L. Welker's Claude Lewis 1, SW NE SE 10-18n-6e, south extension, pumped 10 barrels oil and 60 barrels water from Lower Skinner sand, Pennsylvanian 2809-2813 feet, TD 3447.

Stephens County, Scholem Alechem field. Davidor & Davidor's Towry 1, NE NW SE 25-1s-4w, 2-mile extension, pumped 42 barrels from Tussy sand, Pennsylvanian 3870-3880 feet, 32-gravity, TD 6430.

OKLAHOMA—NEW DISTILLATE FIELD

Oklahoma County. R. W. Hibbert's Ora O. Rice 1, NW NW SW 34-11n-2w, flowed 96 barrels of distillate and 35 million from Basal Pennsylvanian sand 6714-6730 feet, TD 7480.

OKLAHOMA—NEW GAS FIELDS

Payne County. Deep Rock Oil Corp.'s Tyrell A-1, NW NE SW 13-18n-5e, flowed 0.5 million from Skinner sand, Pennsylvanian 3086-3089 feet, TD 3735.

Pittsburg County. Choctaw Gas Co.'s Pilgrim 1, SE SE NW 19-7n-17e, flowed 1.6 million from Hartshorne sand, Pennsylvanian 2625-2715 feet, TD 2770.

TEXAS DISTRICT 1—NEW OIL FIELD

Bexar County. J. D. Bogle et al's Clark-Kempshall 1, H. Nix Survey 36½, pumped 1½ barrels from Serpentine lime, Upper Cretaceous 2236-2252 feet, 45-gravity, completed 6-15-52, TD 2468.

TEXAS DISTRICT 2—NEW OIL FIELDS

Bee County. Newman Bros. Drilling Co.—Alaska Steamship Co. & Calvert Corp.'s H. G. Finke 1, Wm. Allen Survey, flowed 13 barrels from Frio sand, Oligocene 4095-4106 feet, 10/64-inch, 22.6-gravity, completed 8-1-52, TD 5006.

Goliad County. Carnes W. Weaver's H. Arnecke 1, Wm. H. Pendleton Survey, flowed 150 barrels from Jackson sand, Eocene 3877-3880 feet, 11/64-inch, 30-gravity, and flowed 36 barrels distillate and 0.6 million from Slick sand, Eocene 7577-7580 feet, ¼-inch, 60-gravity, completed 6-26-52, TD 7808.

TEXAS DISTRICT 2—NEW DISTILLATE FIELDS

Dewitt County, Arneckeville field. Deep Rock's Melaine Diebel 1, Mumford House Survey, ungauged from Wilcox sand, Eocene 8156-8194 feet, completed 5-22-52, TD 8401.

Arneckeville field. Wm. Hunt Trust Estate's Emilie Junker et al 1, Mumford House Survey, ⅔-mile southwest extension, ungauged from Wilcox sand, Eocene 8174-8182 feet, completed 7-28-52, TD 8550.

Goliad County. Johnny Mitchell's Emil Enke 1, Solomon Griffin Survey, ungauged from 8158-8171 feet, completed 5-8-52, TD 9010.

TEXAS DISTRICT 2—NEW GAS FIELDS

Goliad County. Hickok & Reynolds Royalty Co. & W. L. Pickens' Mrs. Rudolph Martin Est. 1, A. Linville Survey,

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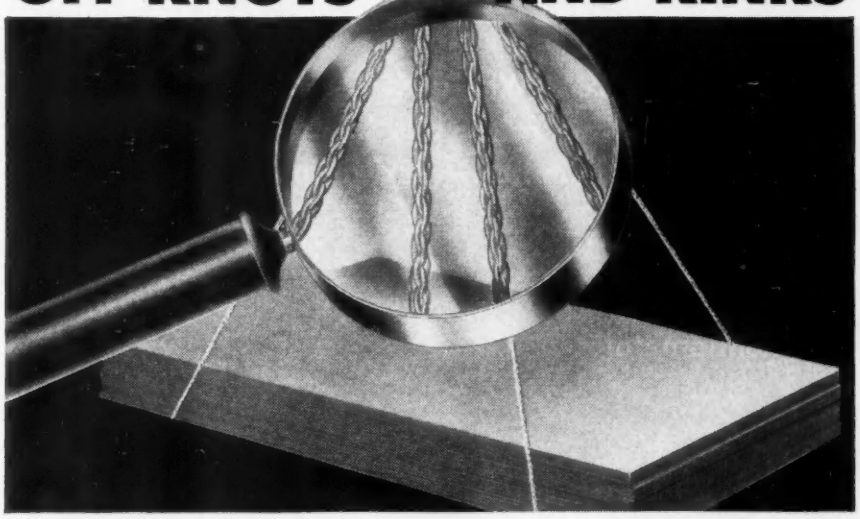

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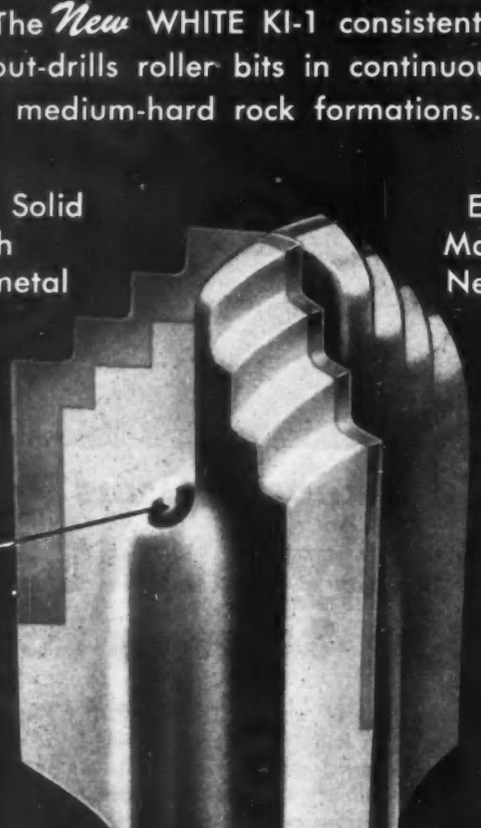
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ungauged from Yegua sand, Eocene 5448-5460 feet, completed 8-1-52, TD 8850.

Jackson County, Wearden field. J. M. Huber Corp.'s Joseph F. Wearden 1, L. D. Cottle Survey, flowed 9.1 million from Vicksburg sand, Oligocene 4636-4638 feet, open completed 7-5-52, TD 5409.

TEXAS DISTRICT 3—NEW OIL FIELDS

Harris County. Tennessee Production Co.'s Percy Holt 1, J. Donnelly Survey, flowed 141 barrels from Yegua sand, Eocene 5828-5831 feet, 9/64-inch, 36.5-gravity, completed 8-30-52, TD 7025.

Matagorda County, Wadsworth field. Magnolia Petroleum Co.'s J. C. Lewis, et al 1, B. F. Jaques Survey, flowed 176 barrels from Frio sand, Oligocene 10,175-10,182 feet, 12/64-inch, 40.9-gravity, completed 8-6-52, TD 12,507.

Polk County, Goodrich area. Currie B. Davis' Charley M. Broman 1, Augustine Viesca Survey, flowed 77 barrels from Jackson sand, Eocene 3426-3432 feet, ⅛-inch, 31.1-gravity, completed 8-8-52, TD 3442.

San Jacinto County. C. C. Gilger Drilling & Exploration Co.'s Emma Bell 1, J. D. Martinez Survey 4, flowed 40 barrels distillate and 3.8 million from Wilcox sand, Eocene 7810-7818 feet, open, 60.8-gravity and flowed 245 barrels oil from Lower Wilcox sand, Eocene 7850-7856 feet, 3/16-inch, 35-gravity, completed 8-6-52, TD 8200.

TEXAS DISTRICT 3—NEW OIL PAYS

Fayette County, Old Arnim field. Sutton Drilling Co.'s E. A. Arnim 1, Menefee ⅓ League, pumped 63 barrels from Wilcox sand, Eocene 2054-2060 feet, 23 gravity, completed 8-4-52, TD 2120.

Hardin County, South Hampton field. Meredith, Clegg & Hunt, et al's Bruce Jackson, et al Unit 2, Henry Binns Survey A-6, flowed 218 barrels from Yegua "B" sand, Eocene 7118-7124 feet, 10/64-inch, 39-gravity, completed 8-10-52, TD 8441.

Sour Lake-Deep field. Sun Oil Co.'s Keith Unit 1, Issac Bridge Survey, flowed 116 barrels from Cook Mountain saind, Eocene 10,235-10,255 feet, 34-gravity, completed 8-10-52, TD 10,354.

Harris County, Finfrock field. The Texas Co.'s H. D. Taylor 1, HT&B RR Survey 7, flowed 76 barrels from Yegua sand, Oligocene 6874-6877 feet, 8/64-inch, 41-gravity, completed 8-8-52, TD 8000.

Liberty County. Sohio Petroleum Co.'s J. C. Baldwin 1, Franklin Hardin Survey, flowed 205 barrels from Yegua sand, Eocene 6388-6389 feet, 12/64-inch, 39-gravity, completed 8-4-52, TD 7660.

Newton County, Brown field. Earl C. Hankamer et al's H. L. Brown 1, Old Well Worked Over, James Henderson Survey, flowed 55 barrels oil and 47 barrels water from 7247-7250 feet, ¼-inch, 42.2-gravity, TD 7740.

TEXAS DISTRICT 4—OIL FIELD EXTENSIONS

Brazoria County, Chenango field. Lamar Hunt Trust Estate's E. P. Robbins 1, Shubal Marsh Survey, ½-mile south extension, pumped 154 barrels from Frio sand, Oligocene 8936-8944 feet, 36.5-gravity, completed 7-27-52, TD 9049.

Newton County, West Bancroft field. The Atlantic Refining Co.'s Kirby Lumber Corp. C-2, Alfred Walden Survey, west extension, flowed 320 barrels from Wil-

cox sand, Eocene 9295-9328 feet, 20/64-inch, 35.8-gravity, completed 7-26-52, TD 9387.

TEXAS DISTRICT 3—NEW DISTILLATE PAYS

Harris County, Clinton field. H. R. Smith et al's Paul Weber Jr. 1, Patrick Reels & John Trobough Survey, flowed 336 barrels distillate and 8.4 million from Vicksburg 8466-8472 feet, open, 58.5-gravity, completed 8-9-52, TD 8500.

Harris County, Fairbanks field. Lee Brothers Oil Co.'s John Windorf 1, George Williams Survey, Lot 33, Hahls Subdivision Farms, flowed 175 barrels distillate and 5 million from Yegua-Cockfield sand, Eocene 7488-7492 feet, open, 49.1-gravity, completed 8-25-52, TD 7930.

TEXAS DISTRICT 3—NEW GAS FIELD

Chambers County. Humble's A. D. Middleton 67, H&TC RR Co. Survey 62, ungauged from Miocene sand 3028-3030 feet, completed 6-19-52, TD 11,270.

TEXAS DISTRICT 3—NEW GAS PAY

Montgomery County, Conroe field. Houston Oil Co. of Texas & Tide Water Associated Oil Co.'s C. L. Dobbins 6, Old Well Drilled Deeper, Ransom House Survey, flowed 16 million from Frio sand, Oligocene 3476-3482 feet, open, completed 7-27-52, TD 3535.

TEXAS DISTRICT 4—NEW OIL FIELDS

Aransas County, Lamar area. Hunt Oil Co.'s State Tract 83-1, Aransas Bay Tract 83, flowed 64 barrels from Frio sand, Oligocene 7248-7263 feet, 3/16-inch, 42-gravity, completed 8-18-52, TD 8694.

Starr County. Jake L. Hamon's Margarita S. de Flores et al 1, Ancinet Jurisdiction of Reynosa, Porcion 40, flowed 33 barrels from Frio sand, Oligocene 4754-4756 feet, 46-gravity, completed 8-13-52, TD 6500.

TEXAS DISTRICT 4—NEW OIL PAYS

Brooks County, Viboras field. Humble's Robert J. Kleberg Jr. Trustee, Sacahuistal Pasture 2, TMRR Survey 77, flowed 51 barrels from Vicksburg sand, Oligocene 8494-8498 feet, 7/64-inch, 38-gravity, completed 8-28-52, TD 12,000.

San Patricio County, Portilla field. Superior Oil Co.'s Minnie S. Welder 2, Old Well Worked Over, Section 23, Welder Ranch Subdivision, C. J. Francisco & E. Portilla Survey, flowed 57 barrels from 9044-9050 feet, 9/64-inch, 33.6-gravity, completed 4-27-52, TD 9629.

TEXAS DISTRICT 4—OIL FIELD EXTENSION

Willacy County, Willimar field. R. H. Abercrombie & V. F. Neuhas' Gorman Fox et al 1, San Juan de Carricitos Grant Share 7, southeast extension, flowed 142 barrels from Frio sand, Oligocene 7780-7806 feet, 9/64-inch, 30.7-gravity, completed 8-29-52, TD 7887.

TEXAS DISTRICT 4—NEW GAS FIELDS

Duval County. Barron Kidd's J. W. Phillips 1, Survey 320, flowed 1 million from Cole sand, Eocene 1720-1722 feet, open, completed 7-5-52, TD 2080.

Jim Wells County. Appell Drilling Co. et al's H. M. Childs 1, W. K. McMaster Subdivision, Lavaca Grant, flowed 5.4 million from Siler sand 4959-4975 feet, 12/64-inch, completed 8-23-52, TD 6340.

Kenedy County. La Gloria Corp. et al's Kenedy Ranch A-3, Rincon del Pen-

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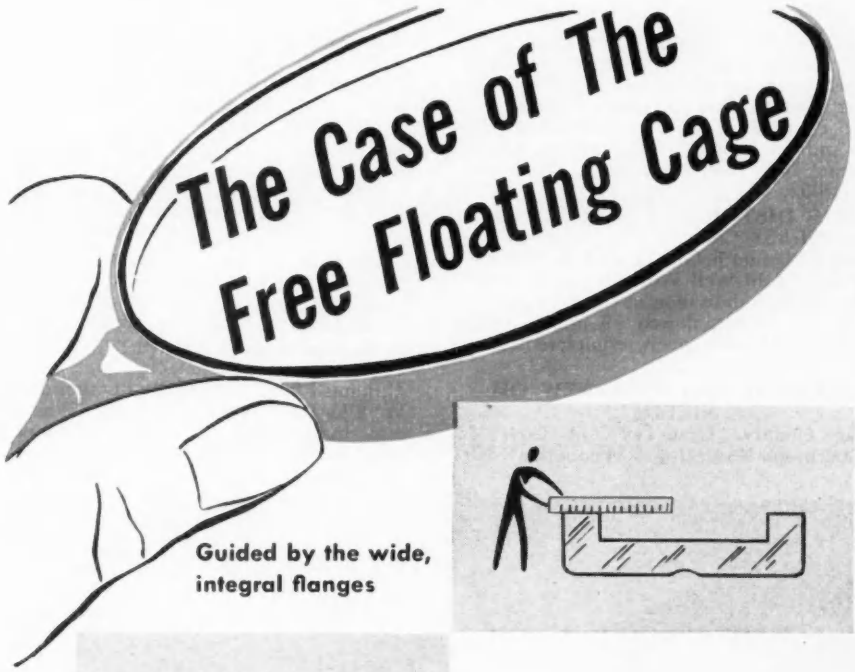

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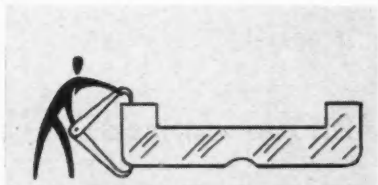

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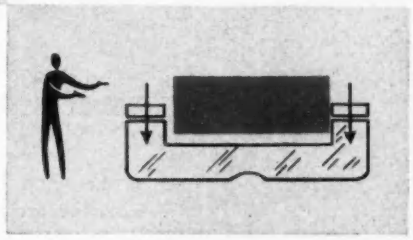

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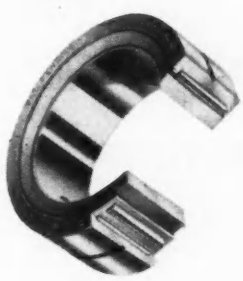

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ascal Grant, flowed 19 million from Vicksburg sand, Oligocene 7033-7050 feet, open, completed 8-13-52, TD 8000.

Starr County. Sun Oil Co.'s Vincenta L. de Penna 2, Santa Teresa Grant, flowed 2 million from Vicksburg sand, Oligocene 7038-7044 feet, open, completed 8-16-52, TD 7330.

TEXAS DISTRICT 4—NEW GAS PAY

San Patricio County, East White Point field. Plymouth Oil Co.'s M. K. & L. B. Cole 3, Old Well Worked Over, George H. Paul's Subdivision of Coleman-Fulton Pasture Lands, flowed 19 million from 4576-4580 feet, open, completed 4-25-52, TD 6788.

TEXAS DISTRICT 7C—NEW OIL FIELDS

Coke County. Laan-Tex Oil Co.'s & Southwest Natural Gas Production Co.'s Russ Mathers 1, Winfred Scott Survey 8, flowed 688 barrels from Strawn sand, Pennsylvanian 6036-6047 and 6069-6098 feet, ⅜-inch, 41.4-gravity, completed 7-25-52, TD 6483.

Irion County. Humble's Pearl Williams B-2, Section 38, Block 21, H&TC Survey, pumped 20 barrels from Wolfcamp lime, Permian 6450-6474 feet, 38.8-gravity, completed 8-22-52, TD 7405.

Runnels County. E. K. & E. M. Burt & West Central Drilling Co.'s E. J. Adami 1, J. C. McKean Survey 534, flowed 372 barrels from 4394-4402 feet, 16/64-inch, 46-gravity, completed 8-28-52, TD 4487.

Unnamed field. Garrett Production Co.'s W. Ellis Lee 1, Section 148, H. Thompson Survey, pumped 19 barrels from Palo Pinto lime, Pennsylvanian 3312-3330 feet, 43-gravity, completed 7-24-52, TD 3618.

Shackelford County, East Lueders-Cook field. Humble's Mrs. Pauline Murrie 1, Ed Williams Survey, flowed 73 barrels from Cook sand, Permian 1764-1784 feet, ¼-inch, 37.8-gravity, completed 8-28-52, TD 1784.

Upton County. Magnolia Petroleum Co.'s TXL P-1, Section 9, Block 41, T&P Survey, flowed 290 barrels from Ellenburger dolomite, Ordovician 13,127-13,152 feet, ¼-inch, 53.5-gravity, completed 8-16-52, TD 13,187.

TEXAS DISTRICT 7C—NEW OIL PAY

Runnels County, Winters field. George Calliham's L. Tinkle 1, Section 333, Block 64, H&TC Survey, flowed 177 barrels from 4186-4190 feet, ¼-inch, 46-gravity, completed 8-2-52, TD 4199.

TEXAS DISTRICT 8—NEW OIL FIELDS

Andrews County. The Texas Co.'s State of Texas 1-Z, Section 22, Block 6, University Lands Survey, flowed 377 barrels from Devonian lime, 12,530-12,590 feet, ½-inch, 43.9-gravity, completed 8-25-52, TD 13,725.

Crane County. Gulf Oil Corp.'s W. A. Estes 11-B, Section 4, Block B-28, PSL Survey, flowed 576 barrels oil and 15 barrels water from Tubb lime, Permian 4620-4700 feet, ⅜-inch, completed 8-15-52, TD 8220.

Martin County. Tom D. Fowler et al's Tant Lindsey 1, Section 16, Block 38, T&P Survey, pumped 8 barrels oil and 5 barrels water from Grayburg lime, Permian 4260-4330 feet, 26.7-gravity, completed 7-26-52, TD 4330.

Schleicher County, "Butler" field. Tucker Drilling Co. et al's Jeff Harkey 1, Old Well Worked Over, Section 77, Block H, GH&SA Survey, flowed 112 barrels from Canyon sand, Pennslyvanian 4851-4855 feet, 3/16-inch, 45-gravity, completed 8-11-52, TD 6188.

Sterling County. Austral Oil Exploration Co., Inc.'s Ellwood Estate 1, Section 78, Block 18, SPRR Survey, flowed 92 barrels from Mississippi lime, Mississippian 8070-8094 feet, 2-inch, 42-gravity, completed 8-12-52, TD 8163.

TEXAS DISTRICT 8—NEW OIL PAY

Ector County, Goldsmith field. Stanolind Oil and Gas Co.'s C. Scharbauer Deep "H" 5, Section 32, Block 44, T&P Survey, flowed 130 barrels from Glorietta lime, Permian 5080-5105 feet, ¼-inch, 37-5-gravity, completed 6-20-52, TD 6320.

TEXAS DISTRICT 8—OIL FIELD EXTENSION

Scurry County, Fluvanna field. Superior Oil Co. & Intex Oil Corp.'s Eva F. Laws et al 516-1, Section 516, Block 97, H&TC Survey, 1¾-mile east extension, pumped 84 barrels from 8186-8245 feet, 38.5-gravity, completed 8-14-52, TD 8400.

TEXAS DISTRICT 8—NEW DISTILLATE FIELD

Pecos County. Phillips Petroleum Co.'s Glenna 1, Section 28, Block 101, TCRR Survey, flowed 4 barrels distillate and 12.3 million from Ellenburger lime, Ordovician 13,700-13,835 feet, 1-inch, completed 8-15-52, TD 14,522.

UTAH—OIL FIELD EXTENSION

Uintah County, Roosevelt field. Gulf Oil Corp.'s Whitlock 1, C SE SW 10-1s-1e, 1½-mile northeast extension, flowed 955 barrels, 1-inch, completed 6-2-52, TD 9660.

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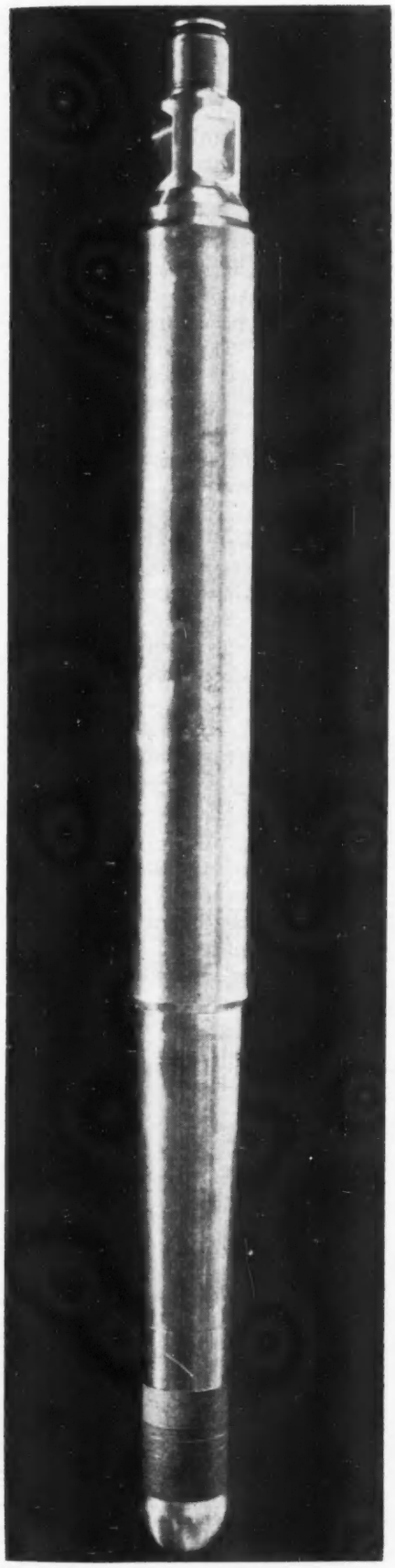


FIGURE 1. Hot wire flow indicator is sensitive instrument capable of detecting extremely small amounts of fluid movement.

Hot Wire Tool Locates Lost Circulation

This instrument simplifies hunt for thief zone and operates on principle of heat transference.

By R. A. HENDERSON
Dowell Incorporated, Hobbs, New Mexico

One of the most difficult and oftentimes costly problems encountered in the drilling of wells is that of lost circulation. While many excellent lost circulation agents are available to remedy this situation, these sometimes fail to shut off the fluid loss into the formation. In such cases it is important that the thief zone be accurately located in order that proper remedial action may be taken promptly.

Normally it is assumed that the lost circulation zone is at the depth which is being drilled at the time the fluid loss begins. Accordingly, remedial measures usually are directed at the bottom of the hole. When such efforts fail, the subsequent mud losses become prohibitively high, especially in deep wells. As there is danger of blowouts or of sticking the drill pipe unless a full column of mud is maintained, the only alternative oftentimes is to set casing, or plug the well. As the cutting samples are lost along with the mud, the operator then is handicapped in identifying and testing possible pay formations.

Lost circulation surveys have shown in many instances that the thief section is not at the bottom of the well, but occurs some distance up the hole. The newly developed hot wire tool has been used in making such surveys, accurately locating the exact zone, or zones, where drilling mud losses are taking place. This permits the operator to spot fillers, cement, plastic or other plugging materials directly opposite the thief formation, instead of having to condition the entire column of mud in the hole. As conditioning increases the cost of the mud approximately tenfold, this can result in considerable savings as it allows the use of smaller amounts of plugging agents with greater probability of success. When the entire volume of mud is conditioned to shut off a lost circulation zone, the concentration of sealing material must be considerably less than if the same material were to be spotted on the thief zone. This is because the heavier concentrations would likely stick the drill pipe if it were attempted to drill. Further, the most successful sealing materials are those which "set up," such as cement or plastic, which, of course, cannot be used as conditioning materials.

An important advantage of a hot wire survey is that it can be conducted directly in the drilling mud or whatever fluid is already in the well. Also, as there are no moving mechanical parts, the danger of nonfunctioning due to clogging the tool with fibrous lost circulation material that may be present in the mud is avoided. The tool is completely streamlined to avoid any accumulation of foreign material on protruding surfaces (Figure 1). In addition, the sensitivity of the tool permits the detection of extremely small amounts

FIGURE 2. Electric pilot truck contains electrical control and recording equipment used in conducting hot wire lost circulation surveys.

of fluid movement, for which it is better adapted than other types of subsurface fluid movement indicators.

The hot wire tool is essentially a flow indicator, designed to measure the flow of fluids passing the tool while it is suspended in the well. It is one of a family of subsurface tools employed in conjunction with the electric pilot (Figure 2). Electrical impulses from the instrument are transmitted through the single-conductor electric pilot cable to the surface, where they are measured by means of sensitive electric meters.

Heat Transference Principle

The tool operates on the principle of heat transference. A heated wire immersed in fluid will dissipate heat continuously into the surrounding fluid. The amount of heat lost per given time interval will depend on a number of factors, such as the temperature of the fluid medium and its heat conductivity. Any movement of the fluid surrounding the heated wire results in an immediate increase in the rate of heat loss. This increase is a function of the rate of flow of the fluid past the heated wire. Thus, by measuring the rate of heat dissipation from the wire, an accurate and extremely sensitive measure of the velocity of the surrounding fluid may be obtained.

The function of the tool is to determine the relative fluid velocity at any particular depth horizon. By checking this velocity at various levels, while fluid is being injected into the hole at a constant rate, the zone of lost circulation may be located. When the tool is below the thief zone, a zero flow condition is indicated. By raising the tool and taking flow readings at successive intervals, the exact depth and extent of the lost circulation zone can be determined.

This information is particularly valuable in those wells where the lost circulation zone is at a higher level than the horizon being drilled. In one wildcat well of this type, the bottom of the hole had been cemented in numerous stages for more than a month before a hot wire survey was run to determine the zone of loss. The hot wire showed the loss to be in a zone several hundred feet up the hole. Following this, a single stage cement job restored circulation and allowed the operator to resume drilling.

In another well, where the operator had been successful in his attempts to restore circulation, three distinct thief strata were located by the hot wire tool. Figure 3 shows the log of this well, and its interpretation. The principal zone of fluid loss occurred at a depth of 6300-6350 feet, with secondary losses occurring at 6200-6260 feet and 6425-6455 feet. These were all readily sealed by spotting plastic lost circulation plugging material opposite the zones taking fluid.

The hot wire has been used successfully in approximately 165 surveys in some 60 wells. The use of this tool has made it possible for operators to shut off zones of lost circulation after every other known technique had failed. Wells that had been without circulation for as much as six weeks were sealed off and drilling resumed, as little as three hours following the completion of the hot wire survey and subsequent conventional shut-off techniques.

It is not always possible to seal off lost circulation caused by drilling into fissures, or similar extraordinary conditions. However, by knowing the zone of loss, the operator can direct his remedial measures to the proper strata, resulting in savings of material, time and money and increasing his chances of effecting a shut-off.

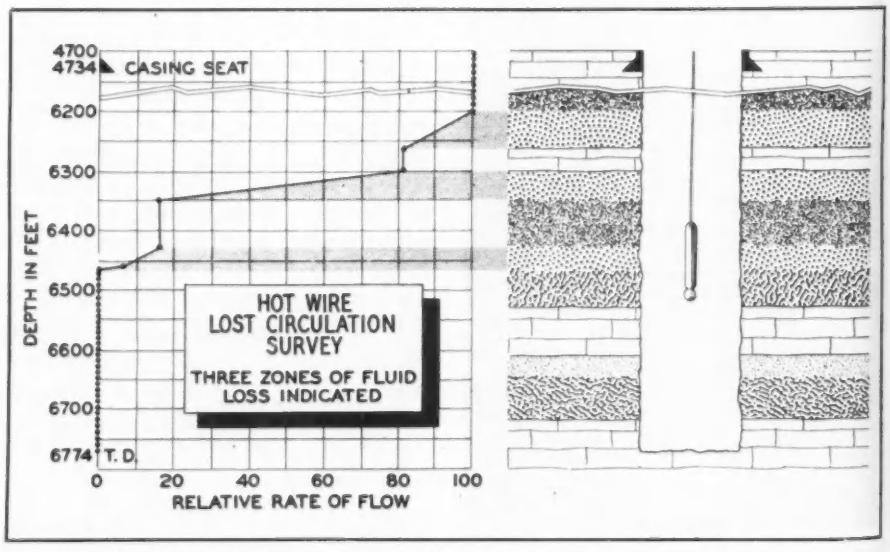
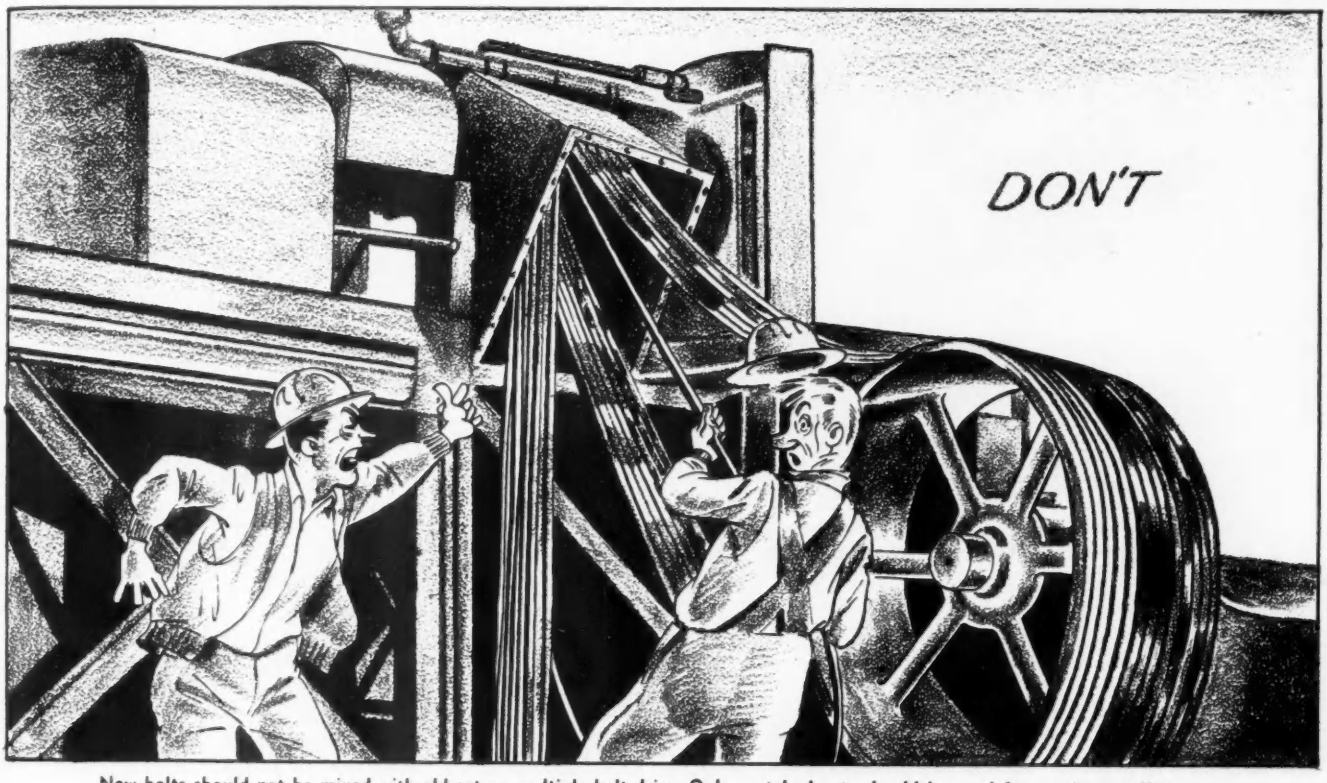


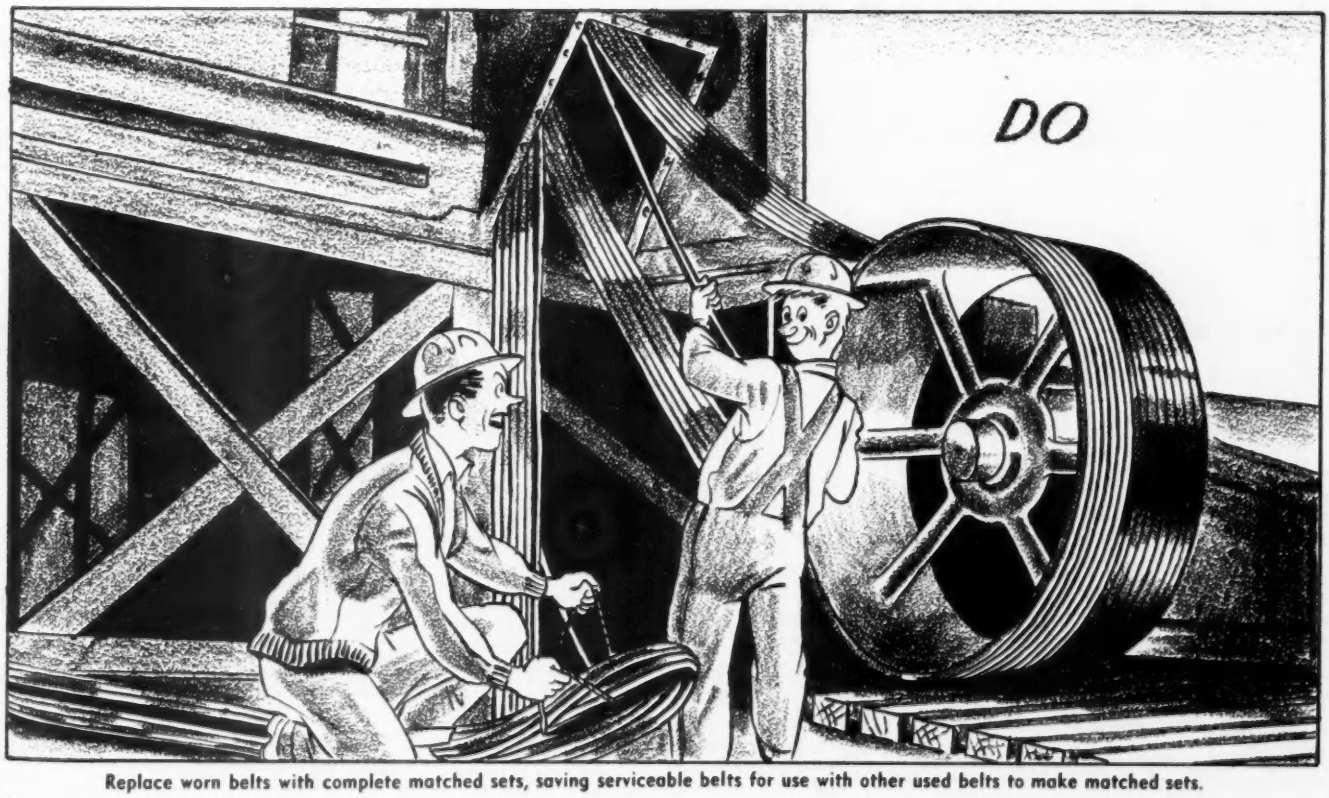
FIGURE 3. Schematic chart shows typical lost circulation survey in which three zones of fluid loss were identified.

Belt Care

World Oil Graphics



New belts should not be mixed with old set on multiple-belt drive. Only matched sets should be used for maximum efficiency.



Replace worn belts with complete matched sets, saving serviceable belts for use with other used belts to make matched sets.

This view of "Cobra" bit shows its general design. Notice "twin-blast" slush nozzle that directs mud circulation to bottom of hole.

Crush-Type Bit Speeds Brittle Formation Drilling

- **Bit footage increased 4 to 8 times.**
- **Penetration rate not reduced by wear.**
- **Provides more economical penetration.**

By E. G. BOICE

Director of Research, Reed Roller Bit Company

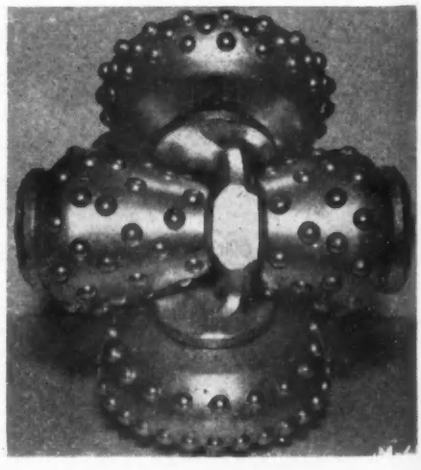
A CRUSH-TYPE hard formation bit known as the "Cobra" has been developed by Reed Roller Bit Company. In extensive field tests this bit consistently gave from 4 to 8 times the footage of conventional bits when drilling extremely hard and brittle formations.

It must be emphasized that the "Cobra" is a special purpose bit in the strictest sense of the word. It was designed for very brittle formations with a high compressive strength. It is *not* a cure-all! Conventional rock bits will, generally speaking, drill a wide range of formations satisfactorily but current field experience with the bit has shown that, as the formation becomes softer, rate of penetration drops off rapidly. In broken formations the bit has a tendency to run "rough."

Basically, the bit uses the same bearings and cross roller design as other hard formation bits manufactured by this company. Instead of conventional teeth on the cutters, however, it has a series of tungsten carbide inserts imbedded in smooth rollers. The contact surfaces of these inserts are spherical in shape, which gives the bit an unconventional appearance.

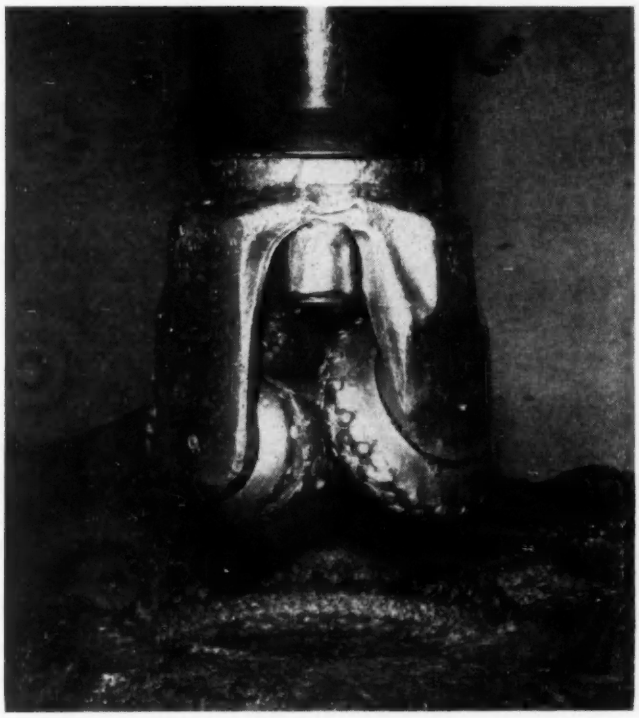
The "Cobra" is as unconventional in performance as it is in appearance. This fact becomes readily apparent when one considers these conclusions that have been derived from experience gained in extensive field tests:

1. **Footage per bit.** In West Texas chert formations (30 percent chert content or better) the bit was found to drill from 4 to 8 times the footage of conventional hard formation bits. In laboratory tests on still harder formations such as pink quartzite (compressive strength from 50,000 to 60,000 pounds per square inch) it was found that the bit would drill 15 to 20 times as much footage as conventional bits.
2. **Rate of penetration** was about three to four feet per hour in West Texas chert formations with the drilling rate falling off in softer formations. The rate of penetration, in the same formation, remains substantially constant throughout the life of the bit. Since rate of penetration does not fall off with bit wear, some form of torque indicator is needed to tell when the cutter bearings are becoming worn. It should be pulled whenever the torque rises appreciably.
3. **Drilling Weights and RPM.** Field experience with bits in the 8¾-inch



Bottom view shows tungsten carbide inserts on cutters. Inserts have been carefully placed to insure uniform wear of cutting elements.

This view of worn bit shows uniform wear on cutters. It is easy to see why drilling rates remain uniform throughout life of bit.



Here's a typical view of "Cobra" bit running on one of the laboratory drilling machines, drilling in granite.

size range indicates that weights of 25,000 to 35,000 pounds are adequate. This is somewhat less than the weights required for conventional bits. Relatively slow rotary speeds of 30 to 50 rpm seem to give best results. It is believed that slow rotary speeds give the fluid time to clean the bottom of the hole, thus avoiding re-cycling of cuttings.

4. **Circulation requirements.** Best results and longest runs have resulted when bottom hole circulation, such as that obtained with "Twin-Blast" slush nozzles, is used. In this connection it is important to pump enough fluid to maintain the high nozzle and return annulus velocities required to keep the bottom of the hole free from cuttings.

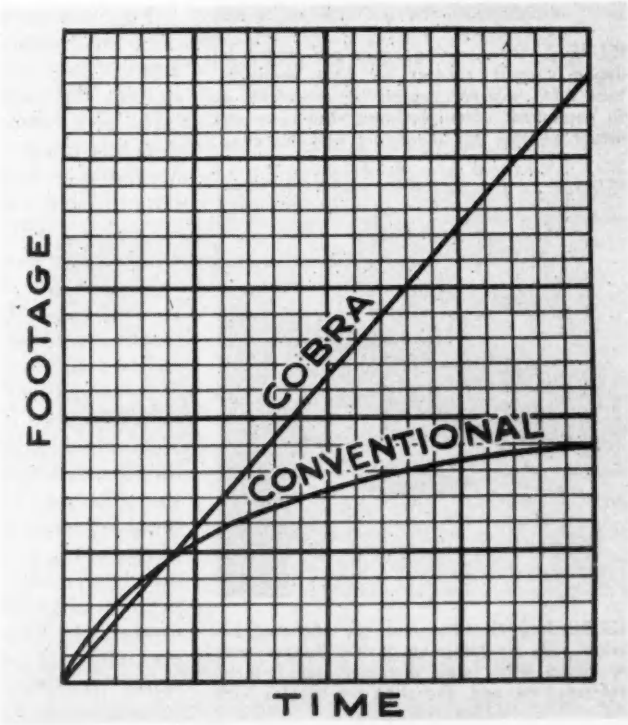
5. **Geological considerations.** Tests have indicated that penetration characteristics of this bit are the reverse of those found when running conventional bits; that is—the harder the formation, the faster it drills. Unless a geologist is warned, he may erroneously conclude that the bit is striking a softer formation when actually it has encountered a harder, more brittle one.

6. **Economic considerations.** It is too early to draw any firm conclusion regarding the economics of running "Cobra" bits but tests indicate that where thick streaks of hard, brittle formation are encountered, there is a substantial economy in round trips and drilling time.

It is believed that bit costs per foot will be comparable to conventional bits in spite of the high first cost of the "Cobra" bit, since each bit gives so much more footage. Many round trips and much rig time are saved, thus effecting an overall economy in drilling costs.

It is impossible to foresee what the development of the "Cobra" will eventually mean to the drilling industry but it is evident that a means has been provided for more economical penetration of known hard formations. The bit may also make possible the exploration and production of pay zones heretofore considered uneconomical to develop.

This graph shows difference in drilling characteristics of "Cobra" bit compared to conventional hard-formation bits.



Racks Designed for Fast Rigging

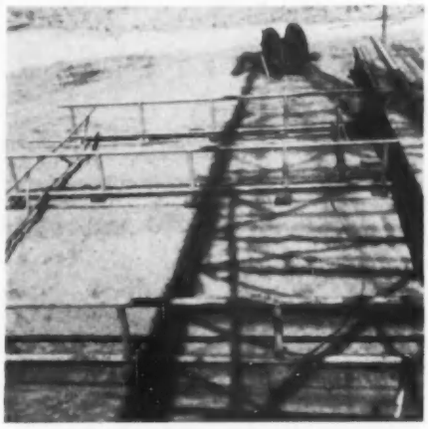


FIGURE 1. Over-all view of demountable pipe racks. Master diagonal supports are welded as one unit while the end separators, bolting to rack, are removable.

Here's an inexpensive, simple unit with main supports tied together by bolted spreaders.

FIGURE 4. Dividers anchor to main supports with lug-and-bolt assembly. Locking one divider involves tightening just four bolts.

FIGURE 2. Extra casing racks are rigged by placing support runners on pipe pedestals. These racks will not support heavy weights as will permanent units. However, they serve important purpose for temporary pipe handling.

FIGURE 3. Rack extensions are anchored together with pin-fastening device. Runner ends are fitted with small diameter pipe inserts. Perforated on end, the slide pin-couples with added extensions.

PIPE rack design possibly offers the most widespread variety in rigup practice seen on location. Constructed of timbers, makeshift pipe structures, and heavy steel plate, some racks offer many possibilities economy wise while others involve considerable fabrication and transport expense.

Reviewing the field of pipe rack design has uncovered the simple, inexpensive and flexible unit illustrated. Not involving complicated structural detail, the units are welded together in a short time while field rigging presents no obvious problem.

Figure 1 shows how the main runners are permanently welded to a length conforming with highway limits. The units are made of five-inch pipe; however, this dimension depends upon the size pipe generally available in surplus stock. It will be noted that the main runners are made with five vertical supports while one end is rigged with pipe slide extensions and the remaining end is perforated to pin lock over a lug welded to the walkway. On sandy locations, it is advisable to rest the main runners on either matting or pieces of heavy lumber.

The end dividers, formed of three-inch pipe, are braced diagonally and the ends are slotted to fit a short segment of strap iron. Strap metal lugs (Figure 4), welded on the main skid members, couple the dividers to assure perfect alignment and sturdy reinforcement. These light-weight dividers, which are shorter than the main skids, present no problem on rig moves.

Figures 2 and 3 show how the extension system is pinned together for field use. Although the extension system is not designed to carry loads equivalent to those resting on the main rack system, it provides a useful service when casing strings are to be spotted on location temporarily.

Pipe pedestals (Figure 2) can be stationed along the extension rail in any number depending upon the load to be supported. The simple pedestal construction consists of shaping each end of a pipe nipple to conform with the metal plate saddle and pipe base. Each segment is secured in place with a heavy bead of welding metal.

Figure 3 illustrates the simple latching device stationed on each end of the master rack skid. The simple design includes placement of a smaller diameter nipple in the skid open end and perforating same. Then the extension rail is ripped and perforated to permit installation ease plus quick latching with the heavy metal rod.

The rack system's basic simplicity permits quick assemblage at a minimum cost. Generally, discarded drill pipe can be used to make this type equipment, hence, the major construction expense involves welding time. However, even this item should be a minor expense.

Supplementary racks add advantage to the plan and field usage indicates that from the standpoint of rigup time plus minimum transportation, the pipe racks will be amortized after just a few moves.

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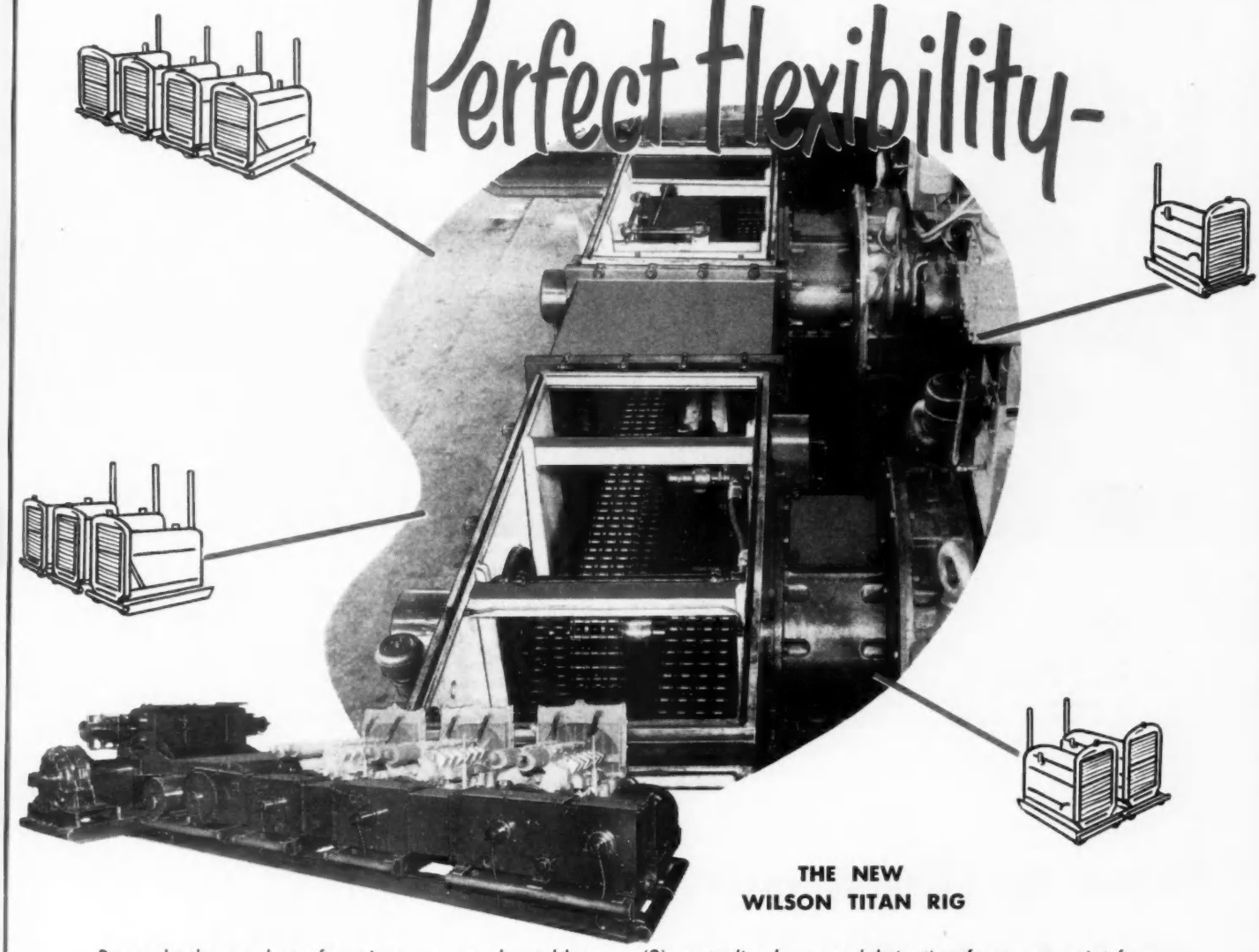

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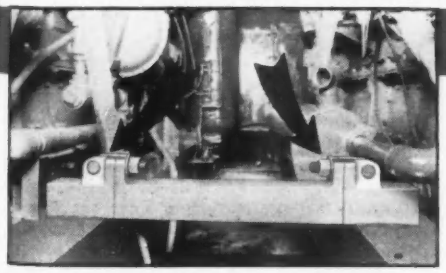

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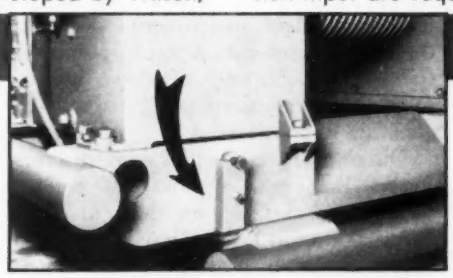
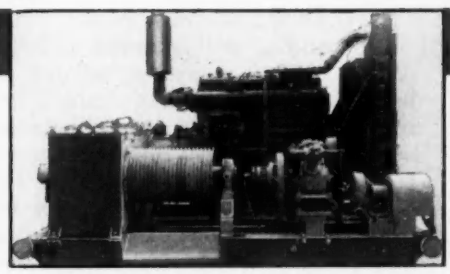


PERFECT CROSSWAYS ALIGNMENT of engines and compound section is assured through the use of WILSON SLIDE BLOCKS.



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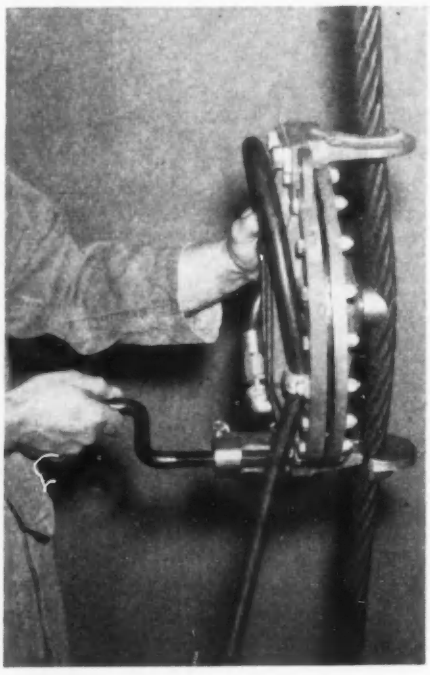
1 It is very important that the spacing between the plug and frame of the diaphragm unit be not less than 3/32-inch nor more than ⅛-inch. Proper spacing will result in more accurate indicator readings. If the spacing is less than 3/32-inch, indicator readings will be low; if over ⅛-inch, readings will be too high. Should the spacing be other than this, it is probable that fluid has been lost somewhere in the system.



2 In mounting the diaphragm unit on deadline, be sure that the bottom hook, or "C"-clamp, is run up properly. The C-clamp should be run up until the line is pulled up snugly against the diaphragm post. Do not use a wrench on the C-clamp crank handle as this may tend to flatten the line. Do not attach diaphragm to deadline while there is a load on the hook. Attach only when empty blocks are laying on floor or are hanging in derrick.

3 It is of utmost importance, on diaphragm deflection type indicators, that the shim in the top hook be changed whenever a different-sized line is used. Always make sure that for a 1-inch line, no shim is used. For a 1⅛-inch line, one shim is used. For a 1¼-inch line, two shims are used. If this is not done, erroneous readings will be indicated. Photograph shows mechanic inserting a shim.

How to Maintain Your Weight Indicator

Here are important points to help increase efficiency and usefulness of this instrument.

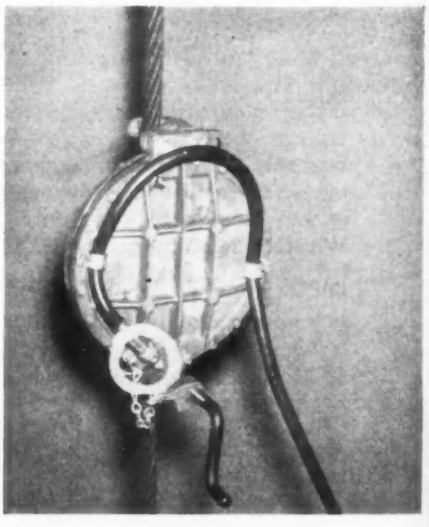
THESE are the days of a rapidly expanding drilling industry. With deeper drilling, increased reliance is being placed on drilling control instruments. And when expanding field organizations mean the training of new men to assume duties on the rig floor, too much emphasis cannot be placed on the proper handling, care and maintenance of weight indicators.

With this in mind, WORLD OIL presents here a review of 13 of the most important points that should be kept in mind in the handling and using of weight indicators.

The Martin-Decker Corporation this year celebrates its 25th anniversary of service to the oil industry in the designing and manufacturing of drilling control instruments. During these 25 years the weight indicator, the most important of these instruments, has taken its place as a most essential tool.

During this period of manufacturing, selling and servicing of weight indicators, certain practices in their installation and care have been developed which materially contribute to their efficiency of operation and, therefore, to their degree of usefulness to the driller and the drilling company organization.

Only two models of weight indicator instruments are shown here. However, the same principles apply to many other sizes and models currently in common use in the field.



4 On the diaphragm type instrument, do not break hose connections or in any way tamper with fittings in such a way that fluid might be lost from system. The diaphragm, hose and recording and indicating gauge units are factory-sealed as a complete unit. When shipped from the factory, system is filled, tested and is ready for installation on the rig. If fluid should be lost through some accidental cause, damage should be repaired and the system refilled. If factory service is not available, follow carefully the steps outlined in factory-supplied manual for re-filling the hydraulic system. It being a hydraulic system similar to that of the hydraulic brakes of an automobile, it is most essential that all air be eliminated during the filling process.

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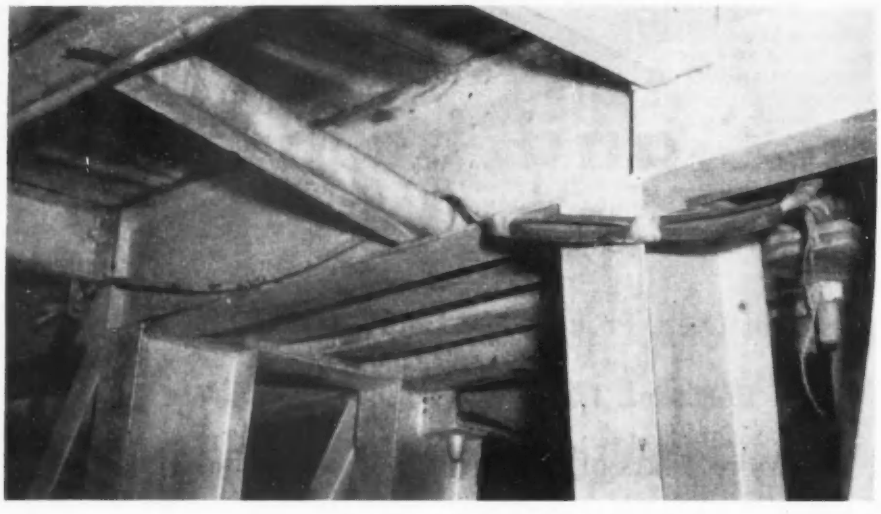
5 It is recommended that the indicating instrument be mounted on an individual post detached from rig floor in order to eliminate or reduce vibrations. There are several good reasons for this:

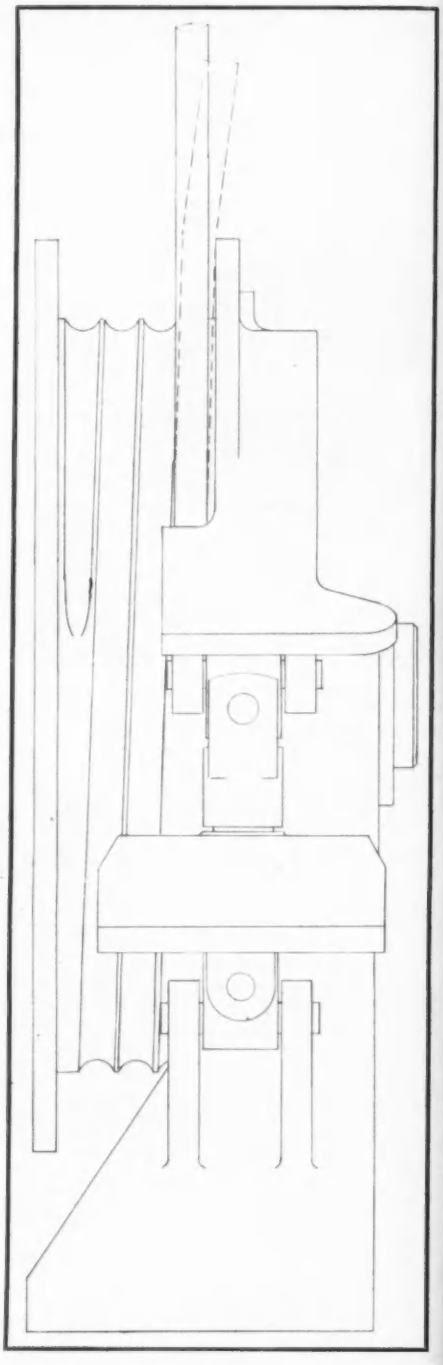
- Vibration unnecessarily wears out instrument bearings.
- Vibrations sometimes will set up false movements of hands which make difficult the close reading of weight differentials.
- It is impossible to obtain satisfactory recording chart when vibrations are superimposed on the true readings.
- Frequently, with excessive vibration, recording pen will deposit excess ink in one spot, causing premature exhausting of ink supply; also, clogging of the pen will result when pen "roughs-up" ink-softened chart paper.

6 For maximum accuracy, place diaphragm unit on deadline at a point approximately level with indicating instrument at driller's position. Reason for this is that if the diaphragm unit should be placed at a higher level, the increase in hydrostatic head of fluid in system will give small, but measurable increase in indicator readings. Opposite effect will be created if the diaphragm unit is mounted at a point below the level of the indicator. If it is necessary to mount the diaphragm higher than the indicator, substract the pounds equivalent to one point of weight for each 26 inches differential in height. The reverse is true if unit should be mounted below indicator level.

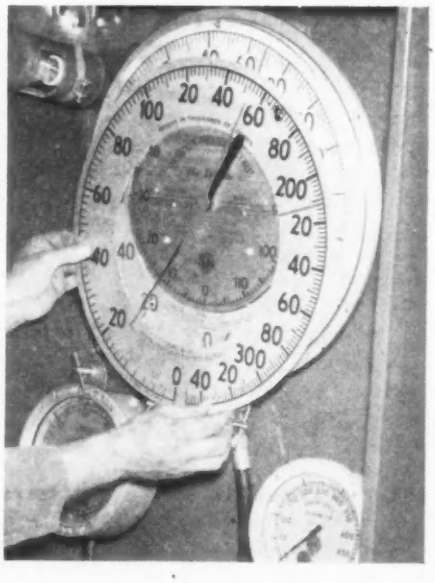
7 Correct procedure for installing weight indicator instruments on rig consists of first bolting instrument box to post at driller's position, then, without detaching hose, passing diaphragm unit through hole in derrick floor behind instrument post. The diaphragm unit is carried beneath the floor and over to the dead line, where it is attached as described elsewhere in this article.



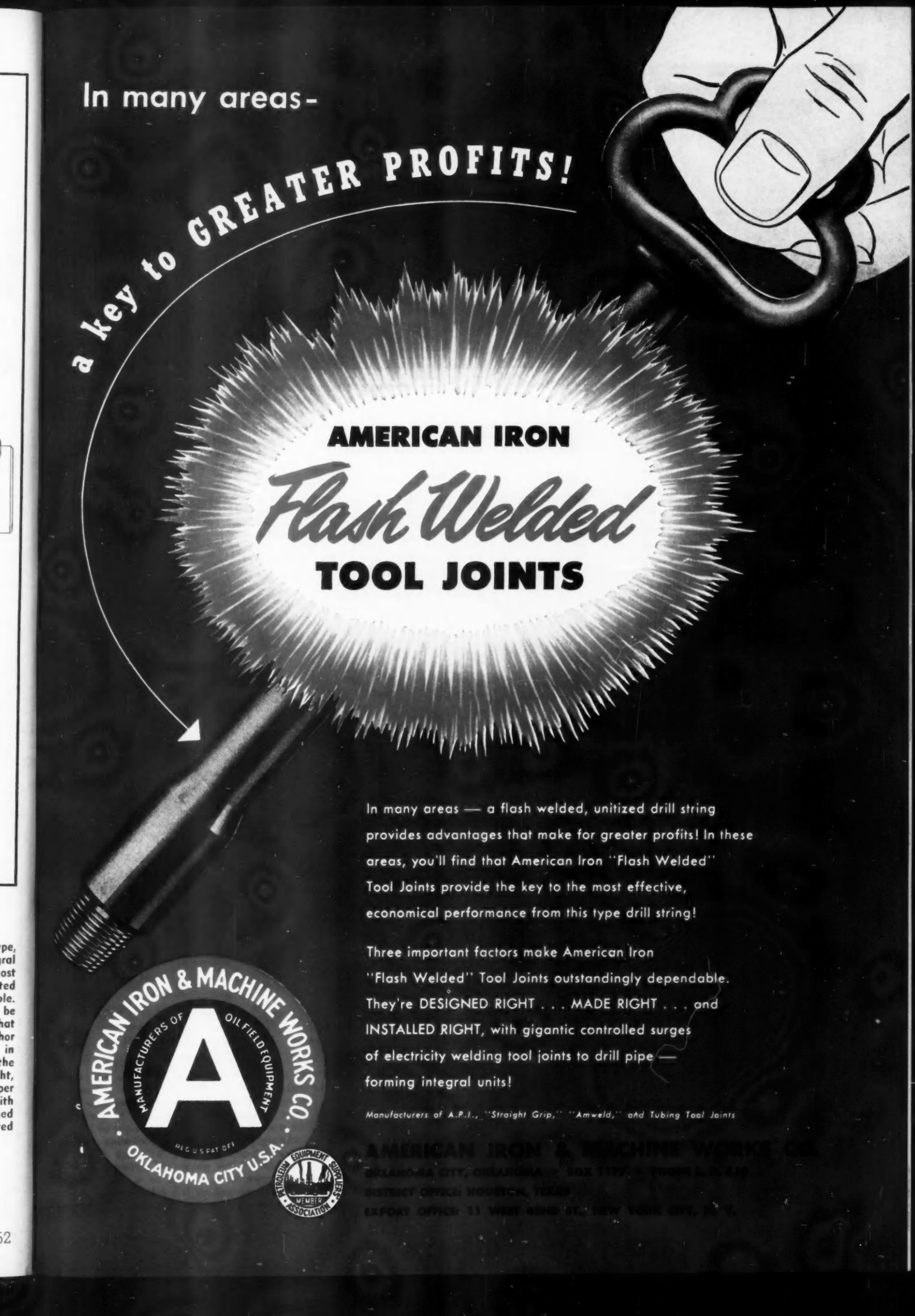
8 Hose connecting the diaphragm and indicator should be tied to sub-structure at convenient places, preferably with aid of soft rope, to prevent excessive chafing of outer cover of hose. Where sharp corners are turned, or where excessive vibrations are unavoidable, enclose hose in short sheath made by slitting short length of salvaged steam hose, or by wrapping in piece of discarded belting.



9 When the instrument is installed on a new drilling job, make certain that proper dial is visible on the indicating instrument. Weight indicator comes equipped with ten dials, each of which shows readings for particular set of conditions. For example, there is a dial for 1⅛-inch line, with eight lines strung; another for the same line with 10 lines strung, etc. At the bottom of each dial is indicated the conditions, i.e., lines strung and size of line, with which the particular dial is to be used. To change dials, remove door ring which is held in place by four ring screws and select dial needed. Before replacing door ring, be sure dial hands do not touch each other, the dial or the door glass.



10 Instruments of the piston-actuated type, wherein the hydraulic piston is an integral part of the deadline anchor drum, give most accurate readings when anchor drum is pointed directly toward the center of the rotary table. If this is not possible, every effort should be made to mount the anchor in such a way that the deadline leaves anchor parallel to anchor drum flanges, as indicated above. Mounted in this manner, there can be no binding of the dead line on the drum flange and a straight, smooth pull is obtained. In sketch, improper mounting is indicated by cable drawn with dashed lines. Straight, vertical pull, obtained with proper mounting of anchor, is indicated by cable drawn with solid lines.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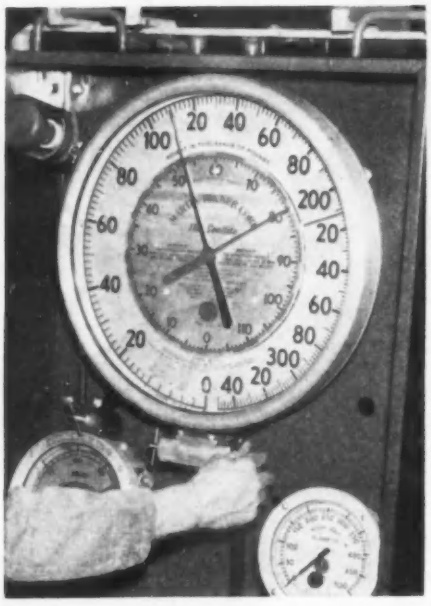
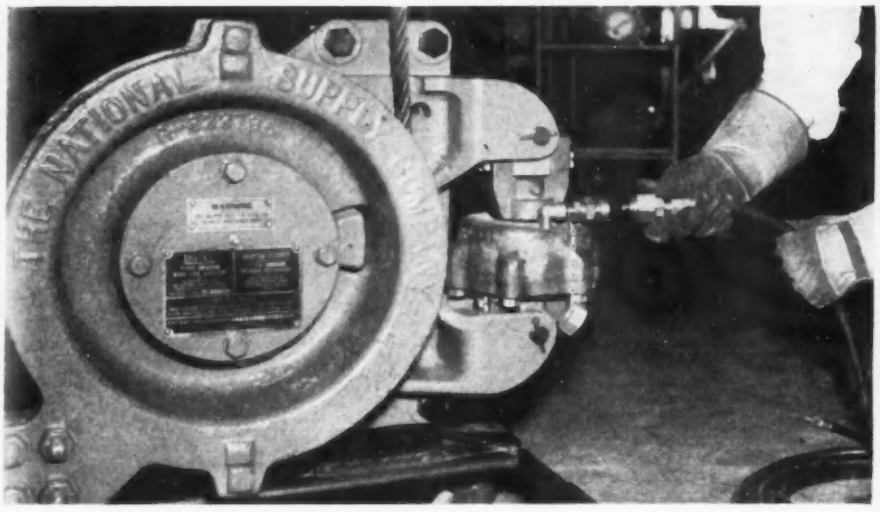
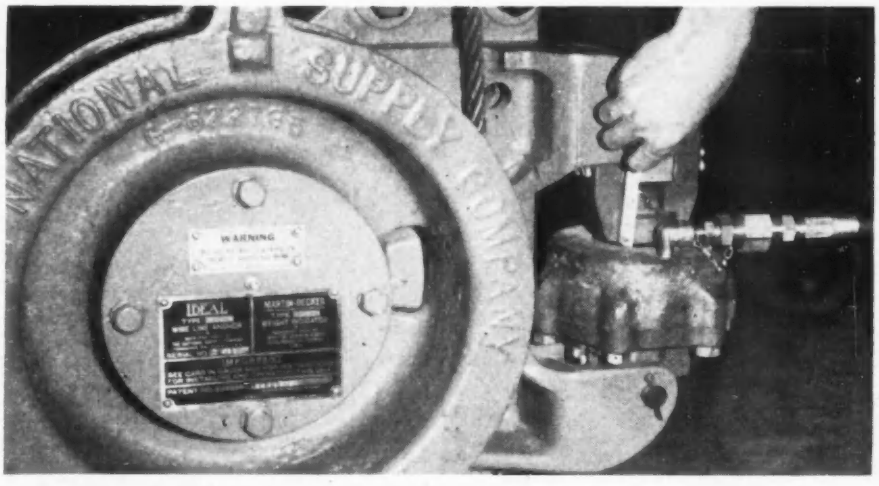


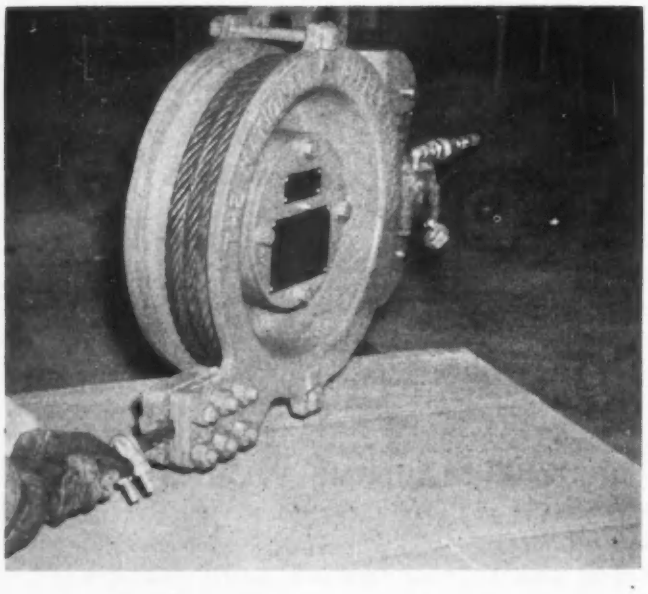
11 Of great importance is proper use of dampers, there being one for each of the hands. It is essential and most desirable that the driller learn to dampen oscillations until a minimum oscillation is obtained for the particular type of drilling or load being handled. Dampers are located directly beneath the indicating gauge; the right damper being for total load, or black pointer; the left damper being for the vernier, or red pointer. If the weight indicator does not "drill off" properly, or is sluggish, check the following items: (1) Pulsation dampers may be closed. Turn to left to open. (2) Hands may be rubbing on glass, dial, or stuck together. Remove gauge ring and correct. (3) Fluid may be lost from system or air may have been admitted. To repair, follow reloading instructions carefully or return to factory for refilling. (4) Gauge movements may have become sticky. Remove gauge ring and center dial; apply cleaning solvent to gears and bearings. Let dry, then oil with light machine oil. When system is in operating condition, gauge hands will oscillate violently when force is applied with screw driver inserted between deflection plug and diaphragm cover, or if hose is shaken vigorously.



12 The design of the piston-type weight indicator, used with the wire line anchor, is such that hose connections can be broken in the field, permitting wire line and weight indicating assembly to remain attached to rig when moving to a new location. Special type, self-sealing couplings permit breaking connections without loss of fluid. Care should be taken to see that dust or grit does not score ground surfaces of coupling seats. Care should be taken in tieing hose to substructure when setting up weight indicator. A dust cap is chained to the piston; also to the disconnect coupling attached to the hose end. These dust caps should be installed whenever coupling is broken.



13 When installing piston-type shown, care should be taken to see that approximately 3/16-inch exists between the piston and cylinder body, as indicated in photograph. Grooves on cylinder neck indicate proper operating range. During normal operations, only one groove is visible. When both grooves (approximately ½-inch apart) are visible, it indicates a loss of fluid and check should be made for a leak in system.



14 Pulling over new line is accomplished easily and quickly with piston-type weight indicator installation. The length of line to be pulled over is first determined and measured out along new line pulled off spool. At that point a cable clamp is attached to line. The six nuts on anchor drum then are loosened slowly until weight of blocks starts to pull the new line through clamp around drum. Allow this to continue until cable clamp reaches anchor clamp, at which time the six nuts again are cinched up tightly. This method of pulling over new line, while not too commonly known, accomplishes in a few minutes what used to require many times that—and far less effort—when blocks had to be lowered to floor and new cable pulled through.

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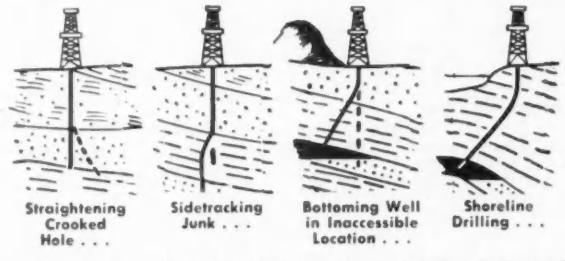

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The test rig with power slips saved 44 minutes per trip in the 8¾-inch hole while one hour and one minute was saved using power slips in 6¾-inch hole. Graphic demonstration shows $1700 saved in 8¾-inch hole and $3650 saved in 6¾-inch hole or $4820 for overall section.

Tests Show Power Slips Will Cut Trip Costs

Here's a way to improve personnel relations and save valuable rig time.

THAT power slip installations for deep drilling are conducive to improved personnel relations is a well established fact. However, more extensive power slip use has proven that aside from offering working condition advantages, they are responsible for very significant savings in time.

The comparison—power versus manually-operated slips—was conducted in the Pegasus field of Magnolia Petroleum Company's West Texas Division. Near comparable rigs were used for the test while drilling conditions paralleled. Since crews assigned to the test rigs were very familiar with the area, no one crew had an advantage over another. In summary, conditions established for this special test were very close from rig to rig. Mechanical recording devices, stationed on each rig, assured accurate test data. Close recorder chart data evaluation permitted allowance for repair and associated down-time.

Inspection of Table 1 will show that the same rig and crews saved an average of 44 minutes per trip on the Windham 1 using power slips when compared to the TXL B-3 where manual slips were employed. In each case, 8¾-inch hole was drilled. This factor alone concurs with the averaged tabulated data and should minimize the personnel and equipment element in the comparisons.

As shown in Table 2, the rig equipped with power slips saved 44 minutes per trip in 8¾-inch hole using 4½-inch drill pipe while one hour and one minute was saved using power slips while drilling 6¾-inch hole. This saving may not seem a large figure in time; however, when one considers that an average of 40 trips are made in the 8¾-inch hole and 91 trips are made in the 6¾-inch hole, the accummulative savings are noteworthy. Actually, a total savings of $4820 was realized in the drilling of these two sections with power slips.

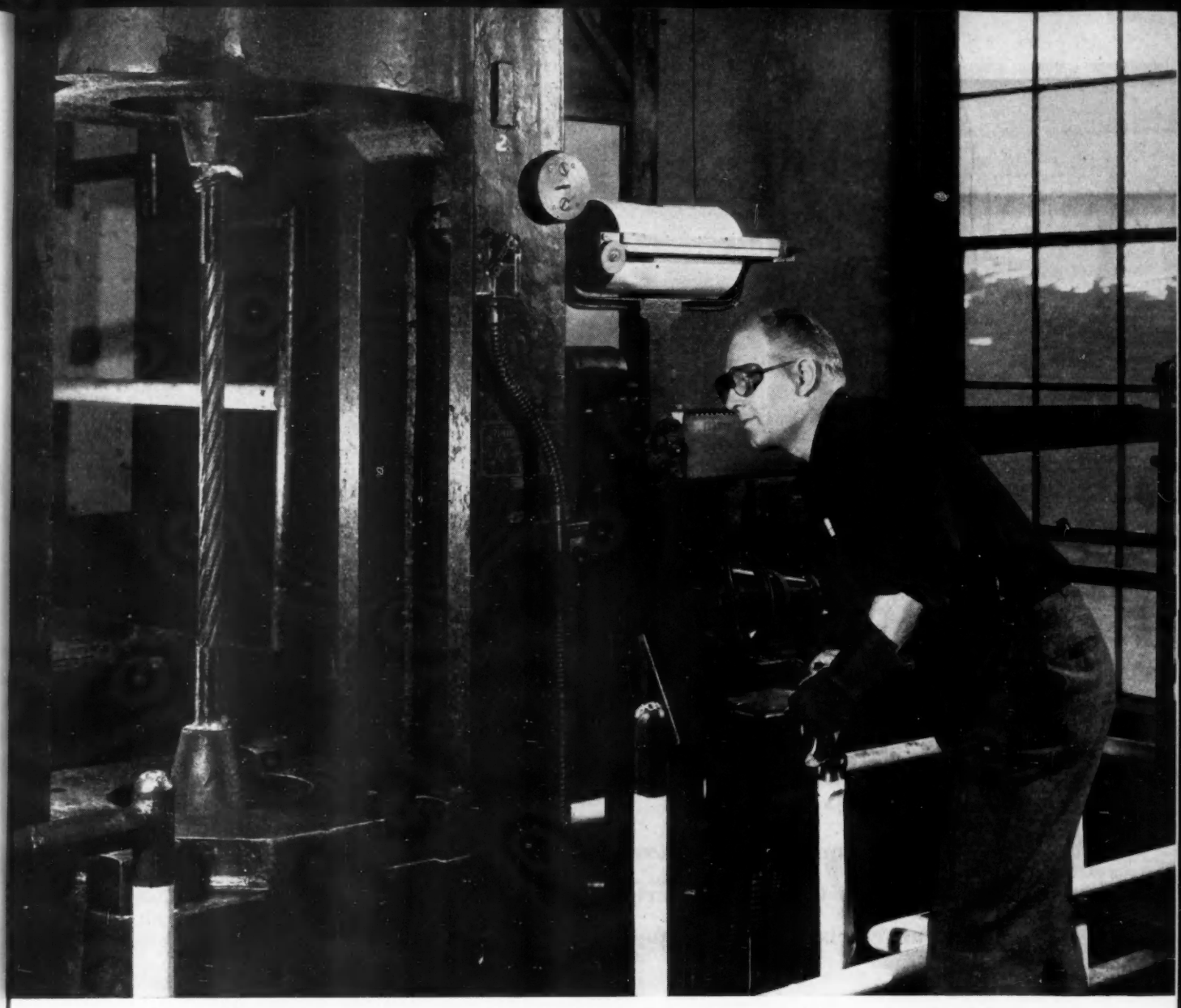
In field use for the past two years, the power slips have not presented any particular maintenance problem and have performed with desirable efficiency.

TABLE 1
Summary of Rig Trip Time
4½-Inch Drill Pipe

Location	Rig	DEPTH From	DEPTH To	Trips	Time	Average Time per Trip	Remarks
Wilson 1	7	4900	9317	44	211 hrs. 47 min.	4 hrs. 48 min.	
TXL B-3	20	4931	9235	39	189 hrs. 8 min.	4 hrs. 51 min.	
TXL C-2	7	4675	9332	43	217 hrs. 11 min.	5 hrs. 3 min.	
Glass 36-3	17	4990	9200	39	156 hrs. 36 min.	4 hrs. 1 min.	
Windham 1	20	4695	9300	45	185 hrs. 30 min.	4 hrs. 7 min.	Power slips (Motors out)
Wilson 2	22	4666	9300	46	193 hrs. 27 min.	4 hrs. 13 min.	
Powell 2	17	4675	9340	34	162 hrs. 24 min.	4 hrs. 46 min.	Motors out
TXL I-1	7	4652	9350	31	146 hrs. 46 min.	4 hrs. 44 min.	Motors out
Wilson 5	22	4674	9325	50	220 hrs. 48 min.	4 hrs. 25 min.	
3½-inch Drill Pipe							
Wilson 1	7	9317	12,922	95	631 hrs. 44 min.	6 hrs. 39 min.	
TXL C-2	7	9332	12,914	84	598 hrs. 8 min.	7 hrs. 7 min.	
Wilson 2	22	9300	12,753	136	838 hrs. 51 min.	6 hrs. 10 min.	
Glass 36-3	17	9200	12,770	95	500 hrs. 42 min.	5 hrs. 3 min.	
Windham 1	20	9300	12,790	91	534 hrs. 4 min.	5 hrs. 52 min.	Power slips

TABLE 2
Analysis of Trip Time

	8¾-Inch Hole, 4½-Inch Drill Pipe		6¾-Inch Hole, 3½-Inch Drill Pipe	
	Hours	Minutes	Hours	Minutes
Average time consumed using manual slips	4	51	6	53
Average time consumed using power slips	4	7	5	52
Time saved per trip	..	44	1	1
Trips in section	40		91	
Total time saved	29	30	92	30
Value of time saved, based on $950 daily rig charge	$1170		$3650	



The rope won't suffer long. First the stretch, then the "bang" as it breaks. Tough on the rope—but it gives us vital information!

Check and test . . . check and test

In the making of Bethlehem wire rope, quality control is a fundamental point. It is a factor as basic as proper design; it is the core, the heart, of our careful manufacturing methods.

Throughout this program of quality control, many different tests are employed, for no single test will suffice. The one shown here is an excellent example —one that is cruel to the rope but that yields vital facts.

Offhand, you wouldn't think that any machine could possibly break that big, stout Bethlehem rope. It is made of tremendously strong steel wires, and it will lift or support many tons. Yet the machine pictured can break the rope in a matter of seconds. Object: to establish the ultimate tensile strength of the rope.

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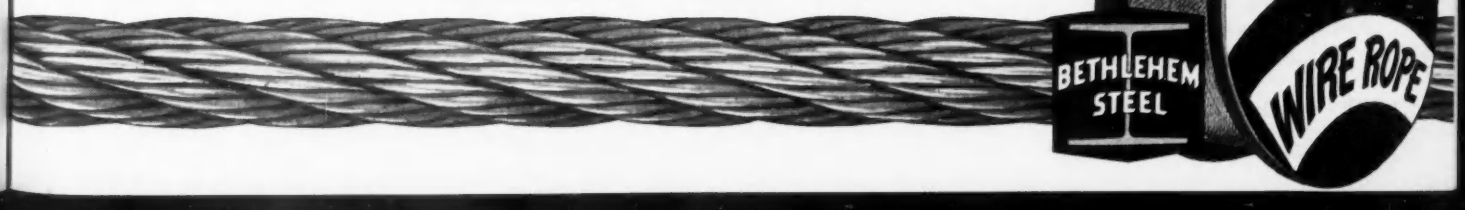

FIGURE 1.

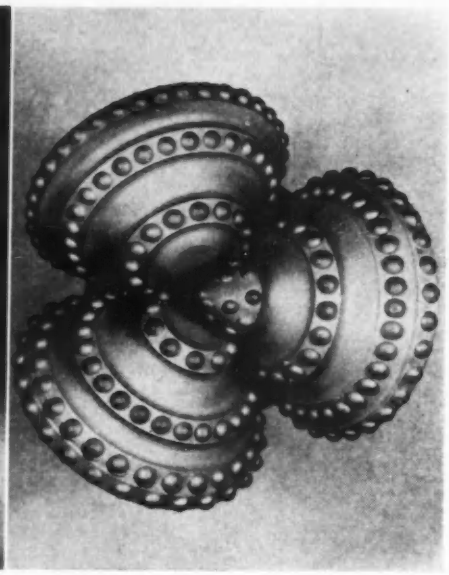

FIGURE 2.

Cutters of R-1 bit studded with hemispherical-ended cylinders of sintered carbide. Left, side view. Right, bottom view.

Improved Rock Bit Lowers Hard Formation Drilling Cost

- **Greater footage reduces round trips.**
- **Optimum weight on bit required.**
- **Characterized by slow speeds.**

By LYLE L. PAYNE
Chief Engineer, Hughes Tool Company

IN RECENT years the search for deeper producing zones has introduced the serious problem of penetrating extremely hard and abrasive formations. Typical examples are the Devonian chert of West Texas or the bromides of Oklahoma. These formations cannot be economically drilled without applying adequate load on the bit to establish a destructive chipping-crushing action as the cutting surfaces rotate on bottom.

Spurred by the desire of reducing the high cost of drilling chert, and hard formations has led to the development of the Hugheset type R-1 rockbit. During the past 12 years numerous attempts were made to use sintered form of carbide on rockbit cutters. The carbides available during most of this period did not have the physical properties required for successful application on rolling cutter rockbits. Over the past few years sintered carbide manufacturers have developed remarkably tough grades for sustaining high-impact stress and still retaining high resistance to abrasion. The application of carbide cutting elements as represented by this bit has been field proven over the past two years.

The bit has given remarkable performance in the hard, abrasive, cherty sections of West Texas and New Mexico, and the hard quartzitic formations of Oklahoma and the Rocky Mountain areas. It is not unusual for one bit to drill three to ten times the footage normally obtained with regular hard formation rockbits in these hard, abrasive formations. The drilling rate will equal that of regular bits, and in some cases has exceeded the rate of regular bits by 50 percent to 100 percent.

The bit may be called a "spot" bit, but its application has been very rewarding in those localities where the "spots" are fairly well established. Experience has shown that not all formations classified as "hard abrasive," in which regular bits give relatively short runs, are economically drilled by the type R-1. Certain sandstones, which have relatively weak binders, and some hard, abrasive shales have not responded to the crushing action. Apparently these formations, in place, must be somewhat plastic and are not friable. Field tests are necessary in determining the suitable formations for the bit.

Tables 1, 2 and 3 were compiled from bit performance records. Referring to Table 1, the average of 128 R-1 bits and 89 W7R bits run in the same formation shows the R-1 has a footage ratio of 4.1 and a penetration ratio of 1.1.

Table 2 lists a limited number of

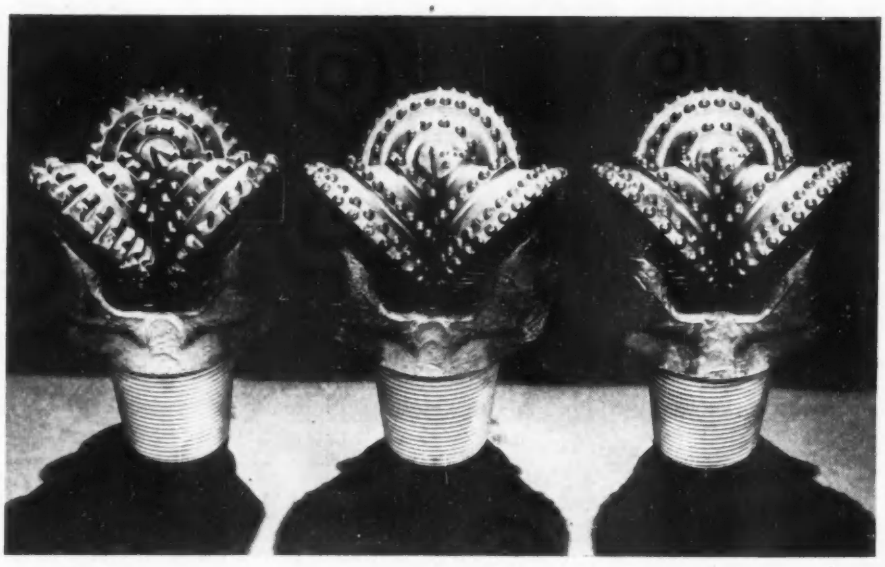

FIGURE 3. Condition of three bits listed in Table 4. R-1 bits show no appreciable wear while W7R (left) has served its useful life.

runs. However, the R-1 footage ratio is 3.6, and the speed ratio is 1.1.

Table 3 lists comparative runs made in Oklahoma, and the average R-1 footage ratio is 2.9. The speed ratio is 1.4.

Table 4 lists part of the bit performance record of a well drilled in Upton County of West Texas. The formation was Devonian lime and chert. The two R-1 runs, compared to the W7R, established a remarkable average footage ratio of 15 and a penetration speed ratio of 3.2.

The condition of the three bits listed in Table 4 is shown in Figure 3. The cutting teeth and gauge surface of the W7R had served their useful life. The bit is well worn. The R-1 bits show moderate carbide breakage, but no appreciable wear off those compacts which are not chipped or broken. The R-1 bits were pulled on the basis of relatively long rotating hours.

It has been found that the best operating practice in drilling chert or chert-bearing limestones is to carry weight on the bit of approximately 4000 pounds per inch of bit diameter, with a rotary speed of approximately 35 rpm. Extremely heavy weights in the range of 5000-6000 pounds per inch of bit diameter are not necessarily economical. Weight applied on the bit, in excess of that required to establish effective chipping-crushing action on the formation, may materially reduce bearing life and also cause more breakage of the sintered compacts. A compromise applied load and a relatively slow rotary speed will normally establish very smooth operation of the bit, which is highly beneficial to long bearing life, and consequently results in more footage per bit. The sintered carbide wears at a very slow rate and will maintain the initial penetration rate over a long period. Apparently only enough weight on the bit sufficient to effectively crush the formation is an optimum practice.

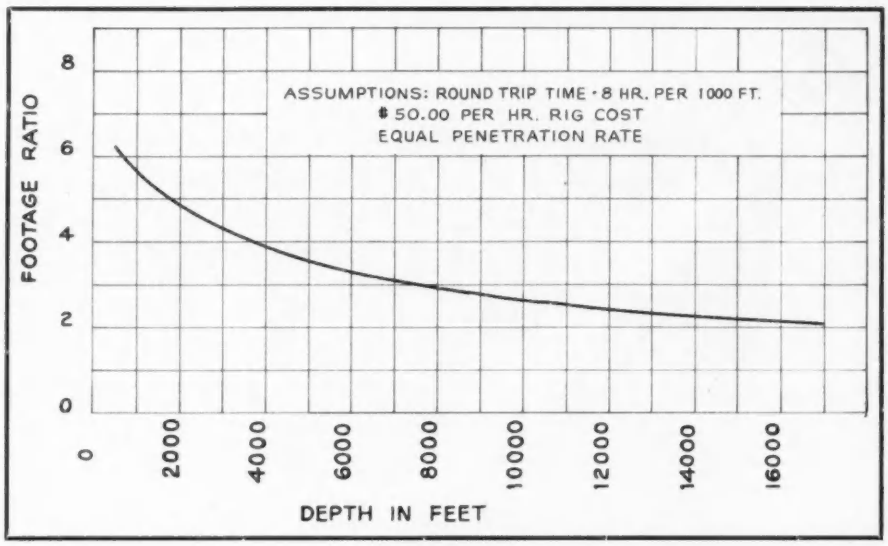

FIGURE 4.

In certain instances the R-1 has been used in drilling a cherty dolomite with an applied bit load in the range 500-1000 pounds per inch of bit diameter. The R-1 footage ratio and speed of penetration ratio, compared to the W7R, were very satisfactory.

In some cases it may be necessary to ream an undersized hole before reaching bottom with this bit. Such reaming should be performed under careful control to avoid imposition of large inward thrust forces which may cause breakage of the gauge-cutting, sintered compacts. It is recommended that reaming be performed at a controlled rate and not exceed ten feet per hour. Furthermore, it is advisable to periodically check the applied torque by disengaging the rotary table drive clutch. Excessive "wind-up" of the drill stem indicates the bit is not reaming freely, and the drill stem should be raised to permit re-reaming at a slower rate. In reaming an appreciable footage of extremely hard, abrasive formation the bit may become undersized and would, upon reaching bottom, drill undersized hole. Such cases may warrant a round trip to change bits in order to drill ahead with a full gauge bit.

The greater footage obtained in suitable formations has paid handsome dividends by reducing round trips, thereby saving rig time and

■ CONTINUED ON PAGE 218

TABLE 1
West Texas and New Mexico

SIZE BIT	Bit Type	No. Bits Run	Total Footage	Total Hours	Average Ft. per Bit	Average Ft. per Hour	Ratio of Footage	Ratio of Speed
7⅞"	R-1	9	442	162.75	49.11	2.72	5.0	1.6
7⅞"	W7R	9	88	52.00	9.78	1.69		
6⅝"	R-1	2	104	56.75	52.00	1.83	5.5	1.5
6⅝"	W7R	2	19	16.00	9.50	1.19		
6¾"	R-1	14	809	309.83	57.79	2.61	4.0	1.1
6¾"	W7R	12	174	70.50	14.50	2.47		
8½"	R-1	2	105	38.75	52.50	2.71	6.6	1.9
8½"	W7R	1	8	5.50	8.00	1.45		
8¾"	R-1	101	7,695	2,863.25	76.19	2.69	4.1	1.0
8¾"	W7R	65	1,245	464.75	19.15	2.68		
All Sizes	R-1	128	9,155	3,431.33	71.52	2.67	4.1	1.1
	W7R	89	1,534	608.75	17.24	2.52		

TABLE 2
Rocky Mountain

SIZE BIT	Bit Type	No. Bits Run	Total Footage	Total Hours	Average Ft. per Bit	Average Ft. per Hour	Ratio of Footage	Ratio of Speed
9"	R-1	4	162	43.50	40.50	3.72	3.6	1.1
9"	W7R	3	34	10.50	11.33	3.24		

TABLE 3
Oklahoma

SIZE BIT	Bit Type	No. Bits Run	Total Footage	Total Hours	Average Ft. per Bit	Average Ft. per Hour	Ratio of Footage	Ratio of Speed
9"	R-1	11	530	229.78	48.18	2.31	2.9	1.4
9"	W7R	11	183	106.76	16.64	1.71		

TABLE 4

SIZE BIT	Type	Depth	Total Footage	Total Hours	Ft. per Hour	Weight	RPM
8¾"	W7R	11,789	8	6½	1.23	35,000	40
8¾"	R-1	12,922	133	31	4.29	40,000	35
8¾"	R-1	13,030	108	30	3.60	35,000	35

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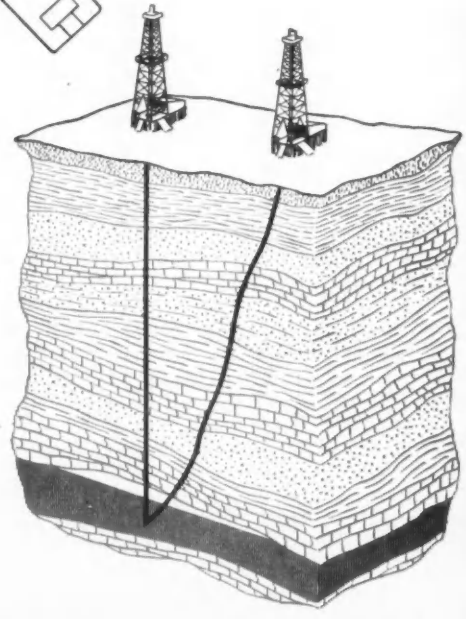
Knowing exactly your inclination and direction at all times is worth more to you than even the cost of a solid platinum Single Shot instrument. And the Sperry-Sun Single Shot gives you this vital information quickly and accurately at but a trifling cost.

The Single Shot prints the inclination and direction on a photo-paper disc. It will give a valid reading only when the instrument is at rest, thus providing a positive check of the accuracy of the reading. Loading and developing the photo-disc and running the survey are so simple that practically anyone can do it. The Single Shot may be run in an open hole, or, using a non-magnetic drill collar (rented from Sperry-Sun) it may be go-devilled or run in on a wire line.

It is just good insurance to run Sperry-Sun Single Shot Surveys in every hole you drill — exact inclination and directional measurements can easily be worth a hundred times the cost involved.



Generally a straight hole is the most economical distance from your derrick to bottom. The Sperry-Sun Single Shot will help keep your hole running the way you want it with little effort and little expense.

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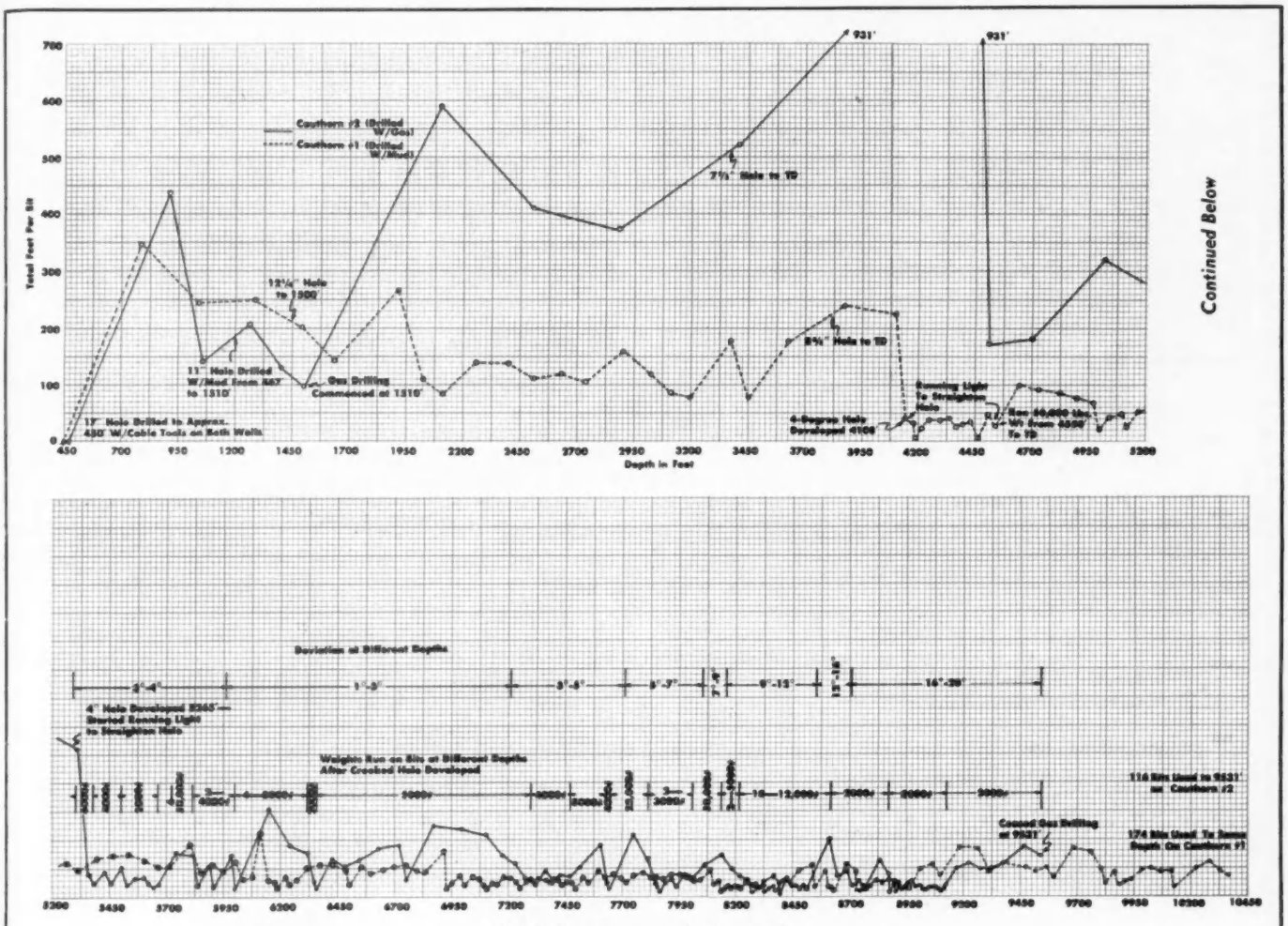
Cauthorn #2 (Drilled W/Gas)
Cauthorn #1 (Drilled W/Mud)
Total Feet Per Bit
Depth in Feet
931'
931'
7⅞" Hole to TD
12¼" Hole to 1500
11" Hole Drilled W/Mud From 867' to 1510'
Gas Drilling Commenced at 1510'
8¾" Hole to TD
Reaming Hole to Straighten Hole
4-Degree Hole Developed 4106'
Continued Below
Deviation at Different Depths
4" Hole Developed 8265'—Started Reaming Hole to Straighten Hole
Weights Run on Bits at Different Depths After Crooked Hole Developed
Ceased Gas Drilling at 9531'

FIGURE 1. Footage per bit vs. depth.

In Selected Areas . . .

Gas Drilling Promises to Cut Costs

- **Results have been phenomenal.**
- **Here's a description of one operation projected from 1510 to below 9500 feet.**

By EARL R. BRUNO
Division Engineer, Western Natural Gas Company

Gas drilling, as indicated by the Western Natural Gas Company Cauthorn Lease operation, promises to reduce footage costs substantially in selected areas. With this advantage, operators will be able to develop marginal properties which they were previously unable to develop because of high drilling costs. Related herein are the problems encountered and the results obtained in using natural gas as a medium of removing cuttings while drilling from 1510 feet to 9531 feet on the Western Natural Gas Company, R. J. Caraway, and Harvey Weir, et al., Cauthorn 2 in the Vinegaronne field, Val Verde County, Texas.

This experiment resulted in almost phenomenal results in increased drilling rate down to a depth of 5293 feet. At this point nine bits had been used during 8½ days total elapsed time as compared to 44 bits and 24½ days on the Cauthorn 1 which is situated approximately ¾ of a mile southwest of the Cauthorn 2 and which used drilling mud as a circulation medium (Figures 1 and 4).

This is believed to be the first instance in which natural gas was used as a circulation medium for the rotary drilling of a long section of hole. El

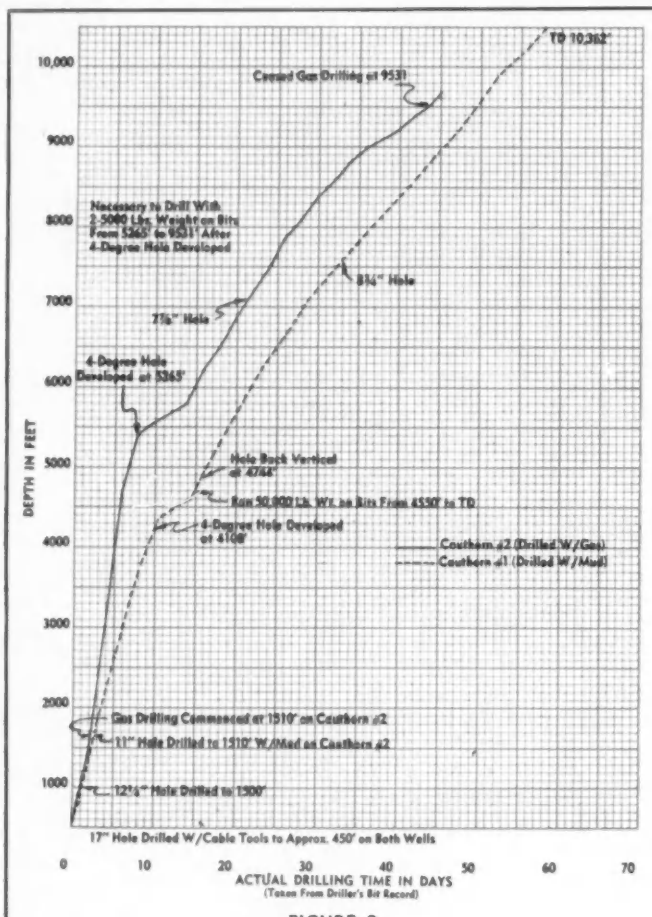
TD 10,362'
Ceased Gas Drilling at 9531
Necessary to Drill With 2-5000 Lbs. Weight on Bits From 5265' to 9531' After 4-Degree Hole Developed
8¾" Hole
7⅞" Hole
4-Degree Hole Developed at 5265'
Hole Back Vertical at 4784'
Run 50,000 Lb. Wt. on Bits From 4550' to TD
4-Degree Hole Developed at 4108'
Cauthorn #2 (Drilled W/Gas)
Cauthorn #1 (Drilled W/Mud)
Gas Drilling Commenced at 1510' on Cauthorn #2
11" Hole Drilled to 1510' W/Mud on Cauthorn #2
12¼" Hole Drilled to 1500'
17" Hole Drilled W/Cable Tools to Approx. 450' on Both Wells
DEPTH IN FEET
ACTUAL DRILLING TIME IN DAYS
(Taken From Driller's Bit Record)

FIGURE 2.

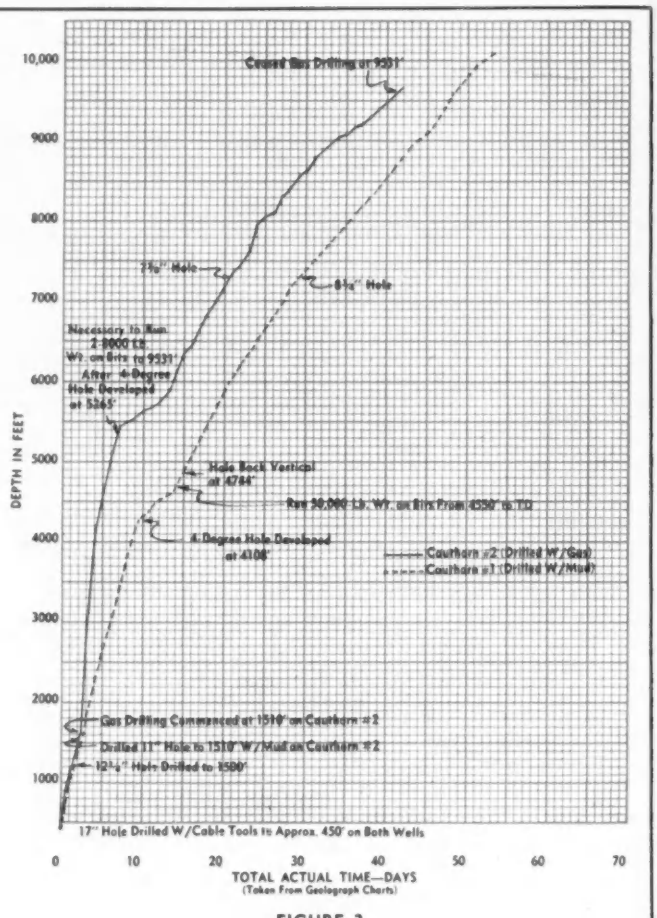
Ceased Gas Drilling at 9531'
7⅞" Hole
8¾" Hole
Necessary to Run 2-5000 Lb. Wt. on Bits to 9531' After 4-Degree Hole Developed at 5265'
Hole Back Vertical at 4784'
Run 50,000 Lb. Wt. on Bits From 4250' to TD
4-Degree Hole Developed at 4108'
Cauthorn #2 (Drilled W/Gas)
Cauthorn #1 (Drilled W/Mud)
Gas Drilling Commenced at 1510' on Cauthorn #2
Drilled 11" Hole to 1510' W/Mud on Cauthorn #2
12¼" Hole Drilled to 1500'
17" Hole Drilled W/Cable Tools to Approx. 450' on Both Wells
DEPTH IN FEET
TOTAL ACTUAL TIME—DAYS
(Taken From Geolograph Charts)

FIGURE 3.

Paso Natural Gas Company and other operators have had marked success in the San Juan Basin in Northern New Mexico by "drilling in" with natural gas circulation. The general procedure in this area is to set casing above the producing horizon with conventional rotary methods and then drill into the producing zone with gas, shoot the well, and clean out with gas. This program resulted in great savings in rig time and bits during the drilling in operations. Also, there have been reports of other operators in West Texas and California who have used compressed air for surface hole drilling or "drilling in" operations.

The discovery well for the Vinegaronne area was the R. J. Caraway et al 1 Guida Rose which was drilled with conventional mud. The second well in the area was the previously mentioned Cauthorn 1 which was also drilled with mud. A total of 192 bits and 116 days were used in drilling the 8¾-inch hole on the Cauthorn 1 to a depth of 10,362 feet. During the drilling of this well various types of mud were tried, including oil emulsion mud, in an attempt to increase the drilling rate, but with no appreciable success. Both of these wells penetrated a long shale section between the surface casing and the producing horizon.

On the Cauthorn 2, which was the third well in the area, it was decided to try gas drilling through the long shale section. Conductor casing was set at approximately 450 feet with cable tools. Surface casing was set at approximately 1500 feet with rotary tools using conventional mud. This was necessary in order to case off any surface water which might be encountered, since the absence of all fluids in the hole is necessary in order to obtain the most favorable results from gas drilling and to eliminate hole trouble. A major portion of the cuttings in the hole are ground to dust in gas drilling and therefore would create a serious hazard if any fluids were mixed with them. It was further decided to stop drilling with gas somewhere above the expected pay zone and drill into the producing formation with mud since the bottom hole pressure of the gas producing zone was expected to be approximately 6800 pounds per square inch which would require a high hydrostatic head for control purposes.

Surface control equipment (Figure 6) consisted of two hydraulically controlled blow-out preventers, (one with blank rams, one with 4½-inch rams to close on drill pipe), one hydraulically controlled flow line valve, a tubing spool with flanged outlets, and a rotating stripper or drilling in head. Two hundred fifty feet of 7-inch flow line was used to pipe the gas and cuttings away from the rig where the gas was burned in a flare. A large diameter flow line was necessary in order to reduce the high velocity abrasive action of the gas and cuttings. The circulation system flow pattern was very similar to drilling with mud. Gas from a nearby source was piped directly into the standpipe: it flowed through the standpipe and drilling hose, into the kelly, and down the drill pipe, and returned to the surface through the annular space, thence out the flow line where it was burned. A pilot flame was kept burning at all times at the end of the flow line. Samples of cuttings were not caught and saved during this operation, but a baffle plate and valve arrangement could have been installed in the 7-inch flow line some 100 feet from the rig for this purpose.

Prior to making a connection or a trip to change bits, the gas was al-

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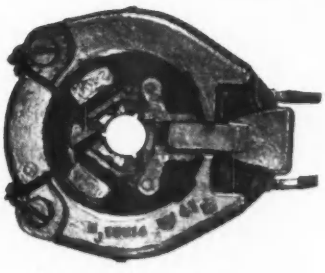

from the top...

from the side...

BJ's new outstanding Power Tubing Spider is designed to give you faster, safer and more efficient operations on tubing jobs... *to put more power to work on your rig!*

BJ POWER TUBING SPIDER IS *FASTER*...the entire operation of the spider is power controlled. A touch of the foot pedal and the slips are instantly *pressure* set or *pressure* raised.

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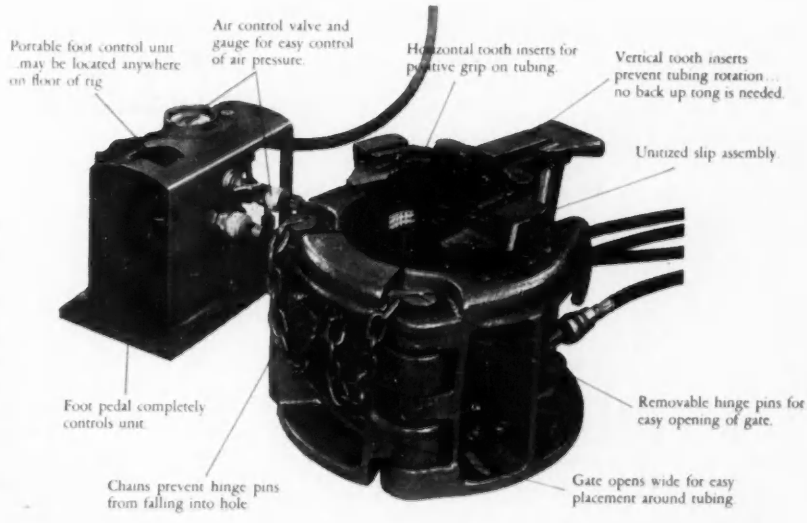
BJ POWER TUBING SPIDER IS *MORE EFFICIENT*...crews work better when they know they are working with a safe power tool. Increased safety and faster trips mean increased efficiency for your entire operation.


Portable foot control unit ..may be located anywhere on floor of rig
Air control valve and gauge for easy control of air pressure.
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Vertical tooth inserts prevent tubing rotation... no back up tong is needed.
Unitized slip assembly
Foot pedal completely controls unit
Chains prevent hinge pins from falling into hole
Removable hinge pins for easy opening of gate.
Gate opens wide for easy placement around tubing

Check the BJ Power Tubing Spider *from every angle*. You'll see the new vertical-tooth inserts which eliminate the need for back up tongs. Check the sturdy hinge pins with safety chains, and the wide angle gate which allows easy placement of the spider around the tubing. Watch the fast operation of the slips and the sure grip of the extra-long replaceable tooth inserts. Slips mechanically lock in up position while running the stand. There's no crimping or bottlenecking of tubing. From every angle you'll discover that for your rig you can't buy a better tubing spider than a BJ Power Tubing Spider.

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lowed to flow until the cuttings or dust were cleaned out of the hole and the gas cleared up at the end of the flow line. The gas was then shut off and the bleed-off line was opened (Figure 6). The flame at the end of the 7-inch flow line was allowed to dissipate before the kelly was broken off. The bleed-off line was then left open as a safety factor against pressure that might build up in the kelly through a leaky valve while the kelly was in the rathole.

Also, prior to making a trip, the rotating stripper head was removed by clamping it to the top joint of the drill pipe, as the first joint was pulled through the rotary, and laying it down to one side. Only three stripper rubbers were used during the entire 81½ days of gas drilling operations.

It was not necessary to use the reverse circulating line in the drilling of the Cauthorn 2. In other areas, operators report that reverse circulation of the gas can be used when fishing for junk in the hole or when small amounts of fluid are encountered.

The gas used to drill this well was obtained from the Cauthorn 1 which had a shut-in pressure of approximately 5200 psi. The pressures and volumes of the gas were controlled by the use of regulators set in Cauthorn 1, and by regulators on the surface flow line. During normal drilling operations the average rate of gas delivery to the drilling rig was one million cubic feet per day at 80 to 100 psi. gauge. This included approximately 150,000 cubic feet per day for the rig fuel necessary to operate the power units of the rig. During the drilling of the well, higher and lower gas volumes and pressures were tried at various depths with no apparent change in the drilling rate. The lowest pressure which was used was 35 psi. gauge with a flow at the rate of approximately 600,000 cubic feet per day. This variation in rate of flow resulted in the calculated linear velocity of the gas flow up the hole to range from less than 1500 linear feet per minute to over three thousand linear feet per minute. No variation in the rate of drilling was noticed throughout these changes. A total of 80 million cubic feet of gas, including rig fuel, was used during the 81½ days of gas drilling.

Conventional Bits Used

Conventional rock bits were run almost entirely. (See Table 1.) A modified bit, with reduced center ports and a small port over each bearing, was tried, but no increase in drilling rate or longer wear of bit was noticed. The conventional bits apparently received enough cooling effect from the reduction in pressure of the gas passing through the ports, since there was very little trouble experienced with the bearings wearing out, or freezing, or cones becoming loose. Reference is made to the bit record where bit No. 5 made 931 feet in 26 hours with approximately 10,000 to 15,000 pounds weight run on the bit. When this bit was pulled, it was fairly dull, but the bearings were in excellent condition. A rotary speed of from 60 to 75 rpm was used throughout the operation.

This gas drilling experiment resulted in the drilling of 8021 feet of formation between the depths of 1510 feet and 9531 feet with good results. The results from 1510 feet to 5293 feet were very exceptional. For the entire gas drilling operation down to 9531 feet, 116 bits and 81½ days total elapsed time were required on the Cauthorn 2, as compared to 175 bits and 93 days on the Cauthorn 1, using the conventional mud drilling method. From 1510 feet to 4350 feet the rate of drilling was 90 feet to 120 feet per hour with 15,000 to 25,000 pounds weight run on the bits. At 4350 feet it was necessary to reduce the weight run on the bits to 6000 pounds because the hole started going off vertical. At 5293 feet a 4-degree hole developed and the weight run on the bits was reduced to 2000 to 6000 pounds to keep the hole within 4 degrees. This resulted in a much slower rate of drilling from that point to 9531 feet. Except for three instances, it was necessary to run light

TABLE 1

Bit Record Cauthorn 2

Size	Bit No	BIT SERVICE—FEET On	Off	Total	Run Hours	Weight On Bit Pounds	Revolutions per Minute	Gas Pressure, Psi.	Deviation Degrees	Remarks
11"	1	473	916	443	19½	.....	.....	Mud	1–476; 1–575	
11"	2	916	1063	147	10¾	.....	.....	Mud	¼–685; ½–786; ¾–898; ¼–995.	
11"	3	1063	1274	211	12¼	.....	.....	Mud	¼–1228	
11"	4	1274	1409	135	11½	.....	.....	Mud	½–1385	
11"	5	1409	1510	101	8¾	.....	.....	Mud	¼–1478	
7⅞"	1	1510	2104	594	11	15–20,000	60	125–90	¾–1820	Pulled green
7⅞"	2	2104	2516	412	7½	15–20,000	60	125–100	1¾–2363	Medium dull-bearing good
7⅞"	3	2516	2892	376	9½	10,000	60	100	1¾–2535	Green
7⅞"	4	2892	3417	525	16	10–20,000	60	150–175	1¼–3235	Medium dull-bearing good
7⅞"	5	3417	4348	931	26	15–20,000	60	175	1¼–3685; 1¼–3987	Dull-bearing OK
7⅞"	6	4348	4401	53	3½	8,000	60	125	2½–4310; 3–4365	Pulled, Green; 4-cone bit to straighten hole.
7⅞"	7	4401	4584	183	12½	6- 8,000	75	125	2¾–4454; 2½–4540	
7⅞"	8	4584	4908	324	17¼	6,000	75	150	2½–4570; 2½–4727	Medium dull-bearing good
7⅞"	9	4908	5170	262	19	6–12,000	60	125	2¾–4845; 2½–4906; 2½–4967; 2½–5026; 2¼–5087; 2½–5147.	Out of gauge
7⅞"	Re-Run	5170	5293	123	6	15,000	60	125	4–5265	Green; Pulled to run different type bit.
7⅞"	10	5293	5333	40	12	6,000	60	125	4–5320	
7⅞"	11	5333	5358	25	10¼	6,000	60	125	3¾–5348	
7⅞"	12	5358	5403	45	13	4,000	75	100	3¾–5380	
7⅞"	13	5403	5430	27	8½	4,000	75	100	3¾–5410	
7⅞"	14	5430	5482	52	12¾	4,000	75	100	3¾–5471	
7⅞"	15	5482	5505	23	16¾	2,000	75	100	3¾–5498	
7⅞"	16	5505	5540	35	14¾	2,000	75	100	3¼–5524	
7⅞"	17	5540	5576	36	16¾	2,000	75	125	3½–5554	
7⅞"	18	5576	5601	25	13	2,000	75	125	3½–5590	
7⅞"	19	5601	5621	20	11¼	2,000	75	100	3–5620	
7⅞"	20	5621	5644	23	10½	2,000	75	100	.....	
7⅞"	21	5644	5722	78	14¾	2- 6,000	60	100	3–5650; 3¼–5710	
7⅞"	22	5722	5798	76	3½	15–50,000	60	150	4–5759; 4½–5789	One cone dull; bearing good.
7⅞"	23	5798	5817	19	2¼	6,000	60	150	.....	Stabilizer—1 drill collar off bottom.
5¾"	24	5817	5829	12	¾	2,000-4,000	30	200	4–5828	Whipstocking to straighten hole.
7⅞"	25	5829	5847	18	¾	15,000	60	125	4–5845	

■ TABLE CONTINUED ON PAGE 212

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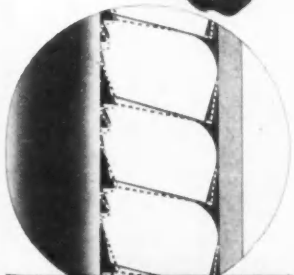
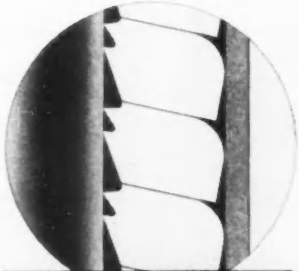
ROLLING DOG ROTARY SLIPS . . .

take a good bite, but not out of your pipe

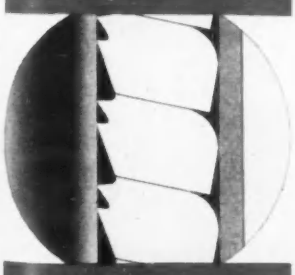
When you set Mission Rolling Dog Rotary Slips, they fully encircle and support your pipe with a uniform, cushion-grip. This exclusive Mission design insures a positive, *instant grip* . . . a smooth, *instant release.* The "bite" is firm and strong even for the longest strings, but Mission Rolling Dog Rotary Slips never cut or bottle-neck pipe. Specify MISSION when you buy rotary slips from your supply store. Mission Slips are easier to handle, easier to service . . . make running and pulling pipe faster and safer.



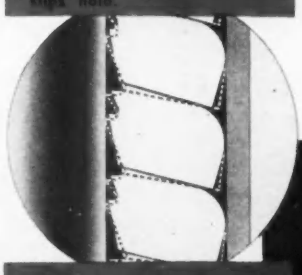
When slips are dropped in bowl, the Dogs roll upward slightly . . . Notice how the Mission tooth design insures positive gripping even after teeth are worn.



When load is being taken by slips, the Dogs roll downward to grip the pipe firmly . . . This positive gripping saves much time usually lost in trying to make ordinary slips hold.



New slips are supporting pipe: The small, non-continuous dog teeth grip the pipe firmly with minimum damage. These teeth give exceptionally long life.



Now load is being taken off slips: Notice how the dogs roll upward and away from pipe—releasing the pipe and freeing the slips from the bowl.

MISSION
MANUFACTURING CO.

HOUSTON, TEXAS
Export office: 30 Rockefeller Plaza, New York

Bit Record Cauthorn 2—Continued

Size	Bit No.	BIT SERVICE—FEET				Weight On Bit, Pounds	Revolutions per Minute	Gas Pressure Psi.	Deviation Degrees	Remarks
		On	Off	Total	Run Hours					
5¾"	Re-Run 24	5847	5856	9	¾	2– 4,000	30	200	3½–5856	Whipstocking
5¾"	Re-Run 24	5856	5876	20	1½	12,000	30	200	5½–5875	Nuckle Joint; Kick Hole Off
7⅞"	26	5847	5876	29	6¾	2– 4,000	60	100	4–5870	Reaming 5¾" Rat hole & trying to knock out 5½" hole.
5¾"	Re-Run 24	5876	5891	15	¾	2– 4,000	30	175	3¼–5886	Whipstocking
7⅞"	27	5891	5966	75	12¼	2– 4,000	60	100	3¼–5944	Stabilizer; 1 drill collar off bottom
5⅝"	28	5966	5981	15	½	6,000	30	150	2¾–5974	Whipstocking
7⅞"	29	5981	6135	154	15½	4– 6,000	60	100	2½–5990; 2–6020 2–6050; 2–6080 1½–6148	Stabilizer; 1 drill collar off bottom Bit dull; bearings OK
7⅞"	30	6135	6225	90	10½	4– 6,000	60	100	1½–6180; 1½–6210	Bit dull; bearings OK; 6 drill collars
7⅞"	Re-Run 25	6225	6289	64	8¼	6– 8,000	60	100	1¾–6244; 2–6274	Bit out of gauge; dull; bearings OK.
7⅞"	31	6289	6303	14	3½	2,000	75	100	2½–6295	3 drill collars; cutting edge gone on bit; bearings good
7⅞"	32	6303	6330	27	9	2– 3,000	75	100	2¼–6325	Bit used up; bearings OK; cutting edge gone; bearings & gauge good.
7⅞"	33	6330	6345	15	5¼	2– 3,000	75	100		Bit dull; bearings & gauge good.
7⅞"	34	6345	6369	24	6½	2– 3,000	75	100	2–6360	Bit dull; bearings & gauge slightly loose & worn; stabilizer 1 drill collar off bottom.
7⅞"	Re-Run 23	6369	6411	42	9	5,000	75	100	2–6411	Bit dull; bearings & gauge OK
7⅞"	35	6411	6465	54	8	3– 8,000	75	100	1¾–6460	Bit dull; bearings & gauge OK
7⅞"	36	6465	6531	66	8½	5000–3,000	75	100	2–6490; 2–6515	Cones worn out; bearings & gauge OK.
7⅞"	37	6531	6614	83	9¼	5,000	75	100	2–6550; 1¾–6580	Cones dull; bearings & gauge OK.
7⅞"	38	6614	6704	90	11½	5,000	75	75	1¾–6614; 2–6636; 2–6670	Cones dull; bearings & gauge OK.
7⅞"	39	6704	6734	30	3	5,000	75	100		Cones dull; bearings & gauge OK.
7⅞"	40	6734	6815	81	10¾	3,000–5,000	75	100	2¼–6785; 2–6810	Cones dull; bearings & gauge OK.
7⅞"	Re-Run 26	6815	6859	44	8¼	3,000	75	100	2½–6848	Bit pulled green.
7⅞"	41	6859	6922	63	13¼	3– 5,000	75	100	2½–6877; 2–6899	Bit dull; bearings & gauge good; * Teeth on side of No. 1 cone cut off with welding torch.
7⅞"	Re-Run 3	6922	6978	56	9¾	5,000	75	175	2–6935; 2–6970	Bit dull; bearings & gauge OK
7⅞"	42	6978	7087	109	14	5,000	75	100	2–7000; 2–7030; 2–7060	Stabilizer 1 drill collar off bottom. Bit dull; bearings & gauge OK.
7⅞"	43	7087	7158	71	11	5,000	75	100	2–7087; 2–7115; 3–7140	Bit dull; bearings & gauge OK.
7⅞"	44	7158	7217	59	8¾	5,000	75	100	2¾–7178; 3–7200	
7⅞"	45	7217	7253	36	7¼	5,000	75	125	3–7233	
7⅞"	46	7253	7286	33	6¼	5,000	75	100	3–7260; 3½–7280	Cones locking; gauge gone.
7⅞"	47	7286	7306	20	7	1– 4,000	75	100	3¾–7294	
7⅞"	48	7306	7351	45	4¾	4,000	75	100	3½–7320; 3¼–7345	Cones dull; bearings & gauge OK.
7⅞"	49	7351	7381	30	6¾	4,000	75	100	3¼–7380	Very dull; bearings & gauge OK.
7⅞"	50	7381	7419	38	5½	4,000	75	100	3¾–7409	
7⅞"	51	7419	7453	34	5¼	4,000	75	100	4¼–7450	Cones dull; bearings good; out of gauge.
7⅞"	52	7453	7505	52	6¾	8,000	60	100	4–7470; 4–7495	Very dull; bearings & gauge OK.
7⅞"	53	7505	7595	90	8¼	8–12,000	60	100	4–7537; 4½–7590	Dull; bearings & gauge OK.
7⅞"	54	7595	7618	23	4	8,000	60	100	4¾–7610	Dull; bearings & gauge OK.
7⅞"	55	7618	7632	14	3½	4,000	70	100		Dull; bearings & gauge OK.
7⅞"	56	7632	7737	105	3	25,000	60	100	4¾–7660; 5–7690; 5¾–7726	Medium dull; bearings bad.
7⅞"	57	7737	7800	63	3	25,000	60	100	6–7750; 6¾–7780	Medium dull; bearings loose.
7⅞"	58	7800	7833	33	6¼	3– 6,000	60	100	7–7811; 7–7826	
7⅞"	59	7833	7847	14	5¼	2,000	75	100		
7⅞"	60	7847	7854	7	2¾	2,000	80	100		Medium dull; bearings & gauge OK.
7⅞"	61	7854	7881	27	6¾	2,000	80	100	7¼–7865	Medium dull; bearings & gauge OK.
7⅞"	62	7881	7911	30	11½	2,000	80	100	6¾–7893	Cones good; bearings locked; gauge OK.
7⅞"	63	7911	7927	16	7¾	2,000	80	100	7¼–7920	Bit medium green.
7⅞"	64	7927	7966	39	11½	2,000	80	100	6¾–7924	Dull; bearings & gauge OK.
7⅞"	65	7966	7999	33	11½	2– 3,000	80	100	6¾–7986	Green bit.
7⅞"	66	7999	8055	56	8	0– 5,000	75	100	6¼–8011	Dull; bearings & gauge OK.
7⅞"	67	8055	8126	71	3	50,000	50	100	7¼–8076	Very dull; left part of bearings in hole.
7⅞"	68	8126	8175	49	8¼	9– 5,000	80	100	12½–8155	Dull; bearings & gauge OK.
7⅞"	69	8175	8210	35	7	2,000	80	100	12–8205	Dull; bearings & gauge OK.
7⅞"	70	8210	8239	29	8½	10–12,000	70	100	12–8230	Bald; bearings & gauge OK.
7⅞"	71	8239	8257	18	4½	10–12,000	70	100	12–8250	Dull; bearings & gauge fair.
7⅞"	72	8257	8279	22	3½	10–12,000	70	100	12½–8275	Dull; bearings & gauge OK.
7⅞"	73	8279	8295	16	4	10–14,000	70	75		Dull; bearings & gauge OK.
7⅞"	74	8295	8321	26	5¼	10–12,000	70	75	12½–8321	
7⅞"	75	8321	8357	36	6	10–12,000	70	75		Dull; bearings & gauge good
7⅞"	76	8357	8381	24	6½	10–12,000	70	75	12–8376	Bald; bearings good; out of gauge.
7⅞"	77	8381	8385	4	¾	10–12,000	60	70		
7⅞"	78	8385	8419	34	6¾	10–12,000	60	70		
7⅞"	79	8419	8438	19	6¼	10–12,000	60–70	60	12–8428	Dull; bearings good; gauge OK.
7⅞"	80	8438	8457	19	5¼	12,000	60	60		Dull; bearings good; gauge OK.
7⅞"	81	8457	8471	14	5¾	12,000	60	60	12–8465	Dull; bearings good; gauge OK.
7⅞"	82	8471	8491	20	5¾	12,000	60	60		Dull; bearings good; gauge OK.
7⅞"	83	8491	8503	12	4¾	12,000	60	60	12–8496	Dull; bearings good; gauge OK.
7⅞"	84	8503	8604	101	10¾	12,000	60	50	12½–8550; 14½–8600	Dull; bearings good; gauge OK.
7⅞"	85	8604	8639	35	6¾	3– 6,000	60	50		Green.
7⅞"	86	8639	8684	45	13	0– 2,000	70	50	16½–8660	Dull; bearings & gauge good.
7⅞"	87	8684	8702	18	10½	0– 2,000	70	50	15–8688	Green.
7⅞"	88	8702	8728	26	4½	6,000	60	50	16–8724	Picked up stabilizer; Ran 1 drill collar off bottom.
7⅞"	Re-Run 87	8728	8745	17	7½	6,000	60	50		Laid down stabilizer.
7⅞"	89	8745	8761	16	6¼	6,000	60	50		Dull; bearings & gauge good; Reamed 5 feet.
7⅞"	90	8761	8825	64	10¾	6,000	60	50	18–8820	Dull.
7⅞"	91	8825	8860	35	11	2,000	60	40	18–8848	Dull; bearings & gauge good; Reamed.
7⅞"	92	8860	8865	5	4¼	2,000	60	40		Reamed.
7⅞"	93	8865	8887	22	9	2– 8,000	60	100		
7⅞"	94	8887	8894	7	4½	2– 8,000	60	100		Dull; bearings loose; out of gauge; Reamed.
7⅞"	95	8894	8909	15	7	8,000	60	100	18–8903	Very dull; bearings loose; out of gauge.
7⅞"	96	8909	8921	12	6	8,000	60	100		Dull; out of gauge.
7⅞"	97	8921	8940	19	8	8,000	60	100	17–8936	Reamed; laid down bottom hole reamer.
7⅞"	98	8940	8966	26	11	8,000	60	100		
7⅞"	99	8966	8981	15	6¼	8,000	60	100	17–8973	Picked up bottom hole reamer; Reamed 15 feet; dull Gauge OK.
7⅞"	100	8981	9000	19	7¾	8,000	60	100	17½–8998	Reamed 10 feet; dressed bottom hole reamer; dull gauge & bearings OK.
7⅞"	101	9000	9013	13	6¾	8,000	60	100		Dull
7⅞"	102	9013	9023	10	6½	8,000	60	80		Reamed ¾ hour; dull; bearings OK; out of gauge sl.
7⅞"	103	9023	9038	15	5½	8,000	60	80–100	16¼–9031	Broke gaslines loose to test for well making gas 4-8 foot flame end 7 inch flow line.
7⅞"	104	9038	9054	16	6	8,000	60	80		Picked up bottom hole reamer; Reamed 1¼ hours.
7⅞"	105	9054	9071	17	6¼	8,000	60	80		Dull; Bearings OK.
7⅞"	106	9071	9083	12	5¼	8,000	55	80	16½–9062	Reamed ½ hour; very dull; laid down BH reamer
7⅞"	107	9083	9092	9	4	8,000	60	80		Very dull; Reamed 40 feet.
7⅞"	108	9092	9103	11	4	8,000	55	100		Reamed ¾ hour; dull gauge wore slightly.
7⅞"	109	9103	9117	14	5¼	8,000	60	80		Medium dull; bearings OK.
7⅞"	110	9117	9165	48	9	2,000	60	75	18¾–9145	
7⅞"	111	9165	9223	58	13¾	2,000	60	75	18¾–9212	Dull.
7⅞"	112	9223	9270	47	13¾	2,000	60	75	20–9250	Picked up BH reamer; Pipe stuck 1 hour; reamed ¾ hour; dull.
7⅞"	113	9270	9318	48	15	2,000	60	75		Green; Laid down BH reamer.
7⅞"	114	9318	9375	57	19¼	2,000	60	50	20–9326	Green.
7⅞"	115	9375	9461	86	20¼	2,000	60	60	20–9360	Slightly dull.
7⅞"	116	9461	9531	70	16	2,000	60	40	20–9528	Slightly dull.

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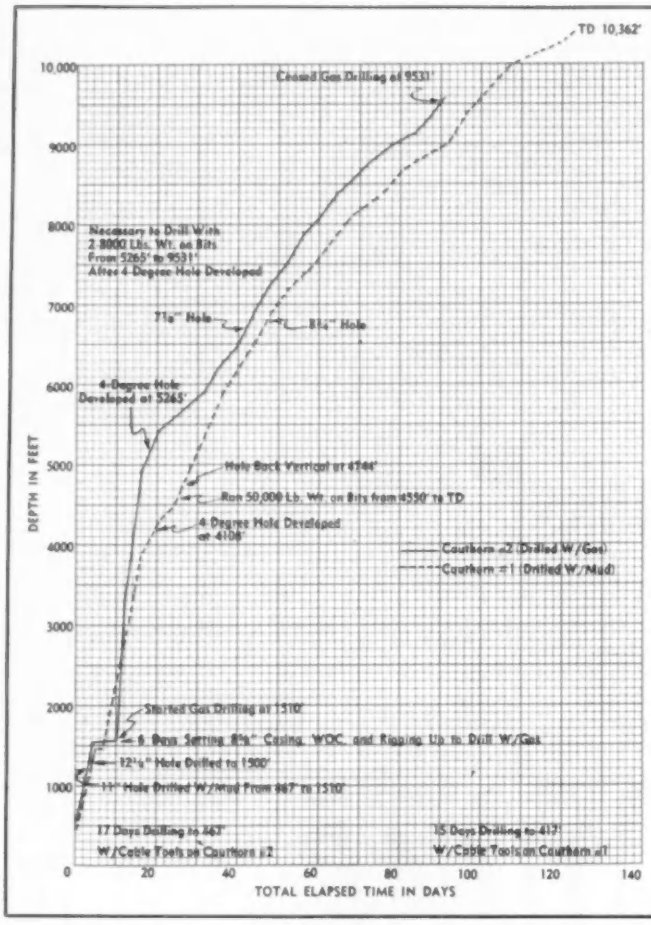

TD 10,362'
Ceased Gas Drilling at 9531'
Necessary to Drill With 2-8000 Lbs. Wt. on Bits From 5265' to 9531' After 4 Degree Hole Developed
7⅞" Hole
8¾" Hole
4-Degree Hole Developed at 5265'
Hole Back Vertical at 4744'
Ran 50,000 Lb. Wt. on Bits from 4550' to TD
4 Degree Hole Developed at 4108'
Started Gas Drilling at 1510'
6 Days Setting 8⅝" Casing, WOC and Rigging Up to Drill W/Gas
12¼" Hole Drilled to 1500'
11" Hole Drilled W/Mud From 967' to 1510'
17 Days Drilling to 967' W/Cable Tools on Cauthorn #2
15 Days Drilling to 417' W/Cable Tools on Cauthorn #1
Cauthorn #2 (Drilled W/Gas)
Cauthorn #1 (Drilled W/Mud)
DEPTH IN FEET
TOTAL ELAPSED TIME IN DAYS

FIGURE 4.

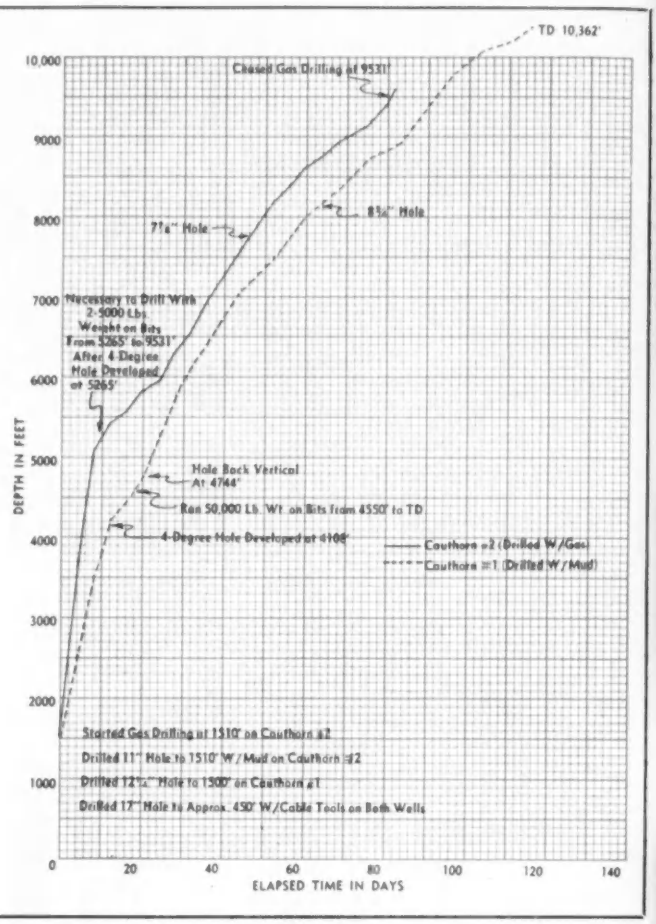

TD 10,362'
Ceased Gas Drilling at 9531'
7⅞" Hole
8¾" Hole
Necessary to Drill With 2-5000 Lbs Weight on Bits From 5265' to 9531' After 4 Degree Hole Developed at 5265'
Hole Back Vertical At 4744'
Ran 50,000 Lb. Wt. on Bits from 4550' to TD
4-Degree Hole Developed at 4108'
Started Gas Drilling at 1510' on Cauthorn #2
Drilled 11" Hole to 1510' W/Mud on Cauthorn #2
Drilled 12¼" Hole to 1500' on Cauthorn #1
Drilled 17" Hole to Approx. 450' W/Cable Tools on Both Wells
Cauthorn #2 (Drilled W/Gas)
Cauthorn #1 (Drilled W/Mud)
DEPTH IN FEET
ELAPSED TIME IN DAYS

FIGURE 5.

on the bits down to 9531 feet, where gas drilling ceased and the hole was mudded up to drill into the high pressure gas zone. At 5722 feet, 7632 feet, and 8055 feet, from 25,000 to 50,000 pounds weight was applied to the bits to see just what rate of drilling would result. In all three instances the rate of drilling was 60 feet per hour or more, but the hole would go off vertical at the rate of ½ degree per 30 feet. It should be mentioned that crooked hole trouble was expected in the drilling of this well, since the operators also encountered the same difficulties in drilling the first two wells in the area.

In attempting to correct this crooked hole trouble, several different types of bits were run, under varying conditions, down to 5817 feet. At this point the operator started whipstocking to straighten the hole from 4½ degrees. After whipstocking five times, the hole was back to 2¾ degrees at 5974 feet. With the use of three drill collars, with a stabilizer run one drill collar off bottom, the hole was brought back to 1½ degrees. However, if more than 6000 pounds weight was run on the bit the hole would go off vertical.

At a depth of 7450 feet, three 7-inch drill collars were run in an attempt to keep the hole straight. The hole was 4½ degrees off vertical at that point and continued to go off.

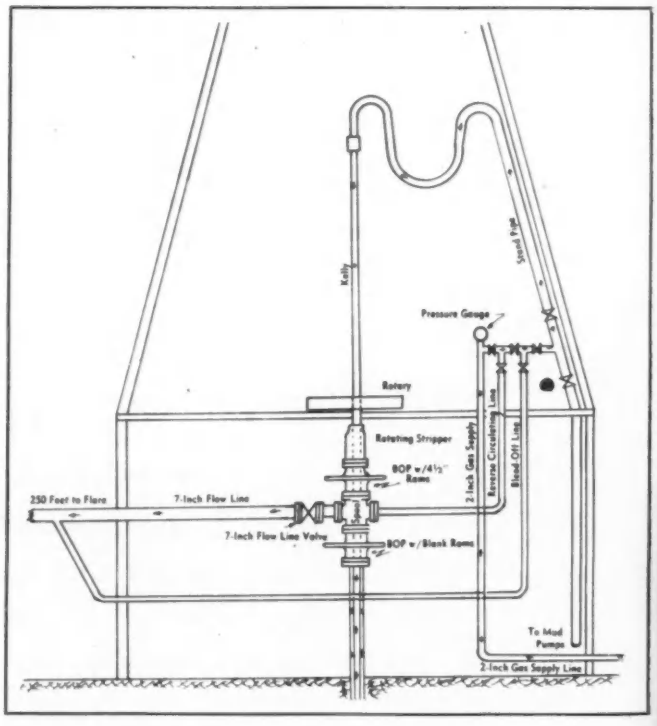
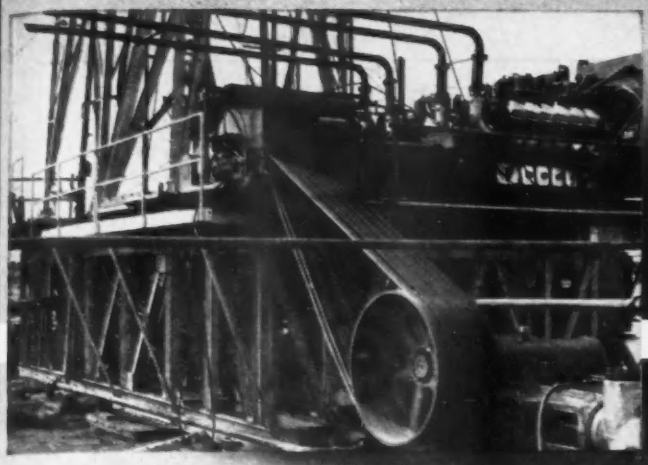


FIGURE 6.

At 7632 feet, a directional survey was run to determine if the hole was deviating in the same direction. This survey showed that the hole was going off in a southwesterly direction from 1510 feet to 3800 feet and it was going off in a northwesterly di-



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rection from 3800 feet to 7632 feet. With this information it was decided to run more weight on the bits in order to increase drilling rate and allow the well to deviate as much as seven degrees. Therefore, 25,000 pounds weight was run on the bits from 7632 feet to 7792 feet at which point the hole was off 6¾ degrees. As a result, the weight was again reduced to 2000 pounds.

At a depth of 8150 feet the hole was 7½ degrees off; and at 8210 feet, because of the slow rate of penetration, it was decided to increase the weight on the bit from 2000 to 12,000 pounds. This weight was run to 8639 feet when it was discovered that the drift indicator readings for the last few hundred feet of the hole were in error. At 8639 feet another directional survey was run and the hole was found to be off 16 degrees at 8632 feet and was still going off in a northwesterly direction. Again, the weight on the bits was reduced to 2000 pounds to 6000 pounds and was maintained at this rate down to 9531 feet. At this depth the hole was off 20 degrees and gas drilling operations ceased.

Just what trouble would result when the hole was first mudded up caused much speculation. In carrying out this operation the operator went to the bottom of the hole with a 7⅜-inch OD bit and one 5½-inch drill collar. The hole was filled with approximately 700 barrels of mud having the following characteristics:

9.5 pounds per gallon weight
56 viscosity
0-0 gel strength
5.0 cc water loss
2/32-inch cake

One 18-inch x 6½-inch pump was used to circulate the mud. The drill pipe was moved constantly and no trouble was experienced with the pipe trying to stick. Returns on the mud were noted at the surface in one hour and five minutes. The mud was then circulated for three circulation cycles before pulling out of the hole. There were no cavings in the mud until after getting back on bottom with a 7⅞-inch bit. No trouble was experienced going in the hole until 9331 feet, where it was necessary to ream from 9331 feet to 9531 feet. There were large amounts of cavings in the returns for about four days, but no difficulty was experienced in getting in and out of the hole.

In future wells drilled with gas, it would appear advisable to use drill collars with the largest diameter, that could safely be run in the size hole being drilled, at the very beginning of the gas drilling operation; and if the hole shows a tendency to deviate, every effort should be made to keep the hole straight by the use of stabilizers. Another feature that probably would be very helpful would be an automatic feed on the rotary brake. In any event, the faster rate of penetration requires greater frequency of deviation surveys in order to have closer control over the straight hole information.

The success of this gas drilling operation was due in a large part to the cooperation of the drilling contractor, The Great Western Drilling Company. The crews were very cooperative in carrying out all the safety precautions prescribed, such: no smoking in the area of the rig, no matches or cigarette lighters allowed on the rig floor at any time, no unauthorized personnel allowed on the rig floor at any time, and continual inspection and correction of mechanical equipment in order to prevent sparks from exhausts. It also was observed that the crews had no objection to working with this gas drilling process, and, in fact, apparently liked the cleanliness feature of the operation.

As more experience is gained, gas drilling promises to reduce footage costs substantially in selected areas. This will enable operators to develop marginal properties which they were previously unable to develop because of high drilling costs.

McLaughlin Named Drilling Editor

Philip L. McLaughlin has been named Drilling Section editor of WORLD OIL. A native of Chanute, Kansas, McLaughlin has been a petroleum, reservoir, and drilling engineer in the Mid-Continent, Gulf Coast and New Mexico areas.

After serving three years with the Army in the European Theatre, he worked for Matson and Towne Oil Company, Production Engineering Laboratories, and Continental Oil Company. In 1948 he entered The University of Texas, where he was president of the student chapter of AIME. Upon graduating in 1951 with a degree in Petroleum Engineering, he joined The Ohio Oil Company, first being stationed at Midland, Texas, and later in Houston as a reservoir engineer.

He succeeds W. B. Colvin, who has been appointed to a position in training and safety work in Venezuela by Socony-Vacuum de Venezuela.

Improved Rock Bit Lowers Drilling Cost

• CONTINUED FROM PAGE 205

wear on equipment. The curve shown in Figure 4 will give an appreciation of this result. Under the assumed conditions, it is calculated the footage ratio required of the R-1 to equal a regular bit's cost per foot of hole drilled at various depths. A brief study of this curve shows the R-1 will lower drilling cost in suitable formations even at moderate depths, but particularly in deep drilling.

Continuing research and development is under way directed at further improvement of the present R-1 design, and to extend the basic principle of the R-1 into modified designs for drilling other abrasive formations of moderate strength.

About the Author

LYLE L. PAYNE was graduated from Rice Institute in 1930 with a B.S. degree in mechanical engineering. He became a regular employe for Hughes Tool Company following graduation and has held various positions during his 20 year tenure. In 1931 he became division manager in West Texas, New Mexico, Canada and Wyoming. From 1940-43 he was a product engineer, and then became assistant chief engineer. In 1948 he was attached as assistant to the staff of the vice president in charge of engineering. He was named chief engineer, the position he now holds, in 1950.

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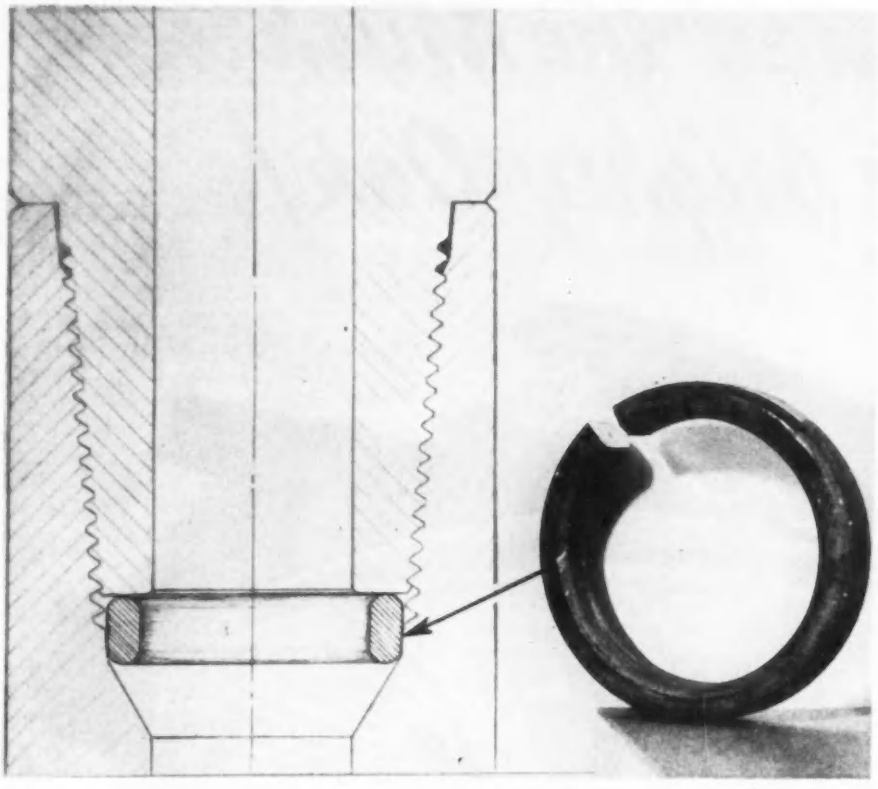

FIGURE 1. Magnesium anode ring with sketch to show position in drill collar box. Rings are inserted in box and pressed into position by end of pin.

New Techniques Improve Drill Collar Performance

Operations in West Texas area provide data for increasing length of service.

By STANLEY C. MOORE

President, Drill Collar Service Company, Midland, Texas

OPERATIONS in the Canyon Reef area of West Texas proved to be harder on drill collars than the average for that section of Texas due to a highly competitive situation requiring maximum performance. A further aggravating factor was the presence of salt in the drilling fluids of such concentration as to be highly corrosive. The 1 to 3 percent salt content commonly found is more damaging than salt water muds which are near full saturation. Because of the high rate of drill collar troubles, many new techniques were tested in the area.

Although intensive drilling activity in the Canyon Reef area is now over, a number of rigs are still active in the area which have operated there for a period of two to three years. The information used in the preparation of this article is based on performance data accumulated on the operation of these and other rigs which were active in the area long enough to establish reliable comparisons.

Three general procedures were followed by operators for determining the useful life of drill collar joints. First, there were those who simply used each drill collar joint until it failed. This method permitted absolute maximum usage of the joints, but fishing costs were so high that only a very few operators found it practical.

Costly Procedure

Second, there were those operators who periodically shopped their entire strings of collars often enough to hold down fishing costs. Such a procedure raised maintenance costs to a prohibitive level. Usage of joints was minimum and it was not long until the drill collars became so short that additional length had to be "stubbed" on the ends at considerable cost. Further, a new hazard of failure in the stub welds was introduced.

The third procedure was to inspect the drill collars at regular intervals for fatigue cracks and other damage or defects. This method was used by most operators as it held fishing and maintenance costs to a minimum. This article is based on data obtained from the rigs of operators who followed this procedure.

Increased Service Life

There are a number of things operators did to increase the service life of drill collar joints. The most important of these are discussed separately below.

Care in handling and correct lubrication are omitted. It was noted that improper handling was only rarely a cause for rejection of joints and that all operators apparently had achieved satisfactory lubrication using the metallic lead base lubricants considered standard for drill collars in this area.

LIMITATION OF ROTARY SPEED. This factor appears to have had more bearing on ultimate life of drill collar joints than any other. In the hard formations of the area, the rate of damage to joints increases sharply as speeds of 90 to 100 revolutions per minute are approached.

COLD WORKING THREAD ROOTS. It generally is recognized that the fatigue strength of both pins and boxes can be materially increased by proper cold working of thread roots by either of the established rolling or peening processes.

PROTECTION OF BOXES FROM CORROSION. Box failures so prevalent in the area can definitely be attributed to

FIGURE 2 (left). Cross-section of 60 and 90° thread forms showing correct and incorrect machining of roots and crests.

FIGURE 3 (right). Torque control instrument fastened into snub line leading to tongs. As drill collar joint is tightened, the tension in the line increases until it reaches level at which the instrument has been set to trip. A loud report signals driller that desired torque has been reached.

corrosion fatigue. Cracks develop in the thread roots in the box which are exposed to corrosion, and propagate outward. The benefit to be expected from cold working these thread roots is not realized fully unless they are protected from corrosion. The most widely used method of slowing corrosion in the box is installation of a magnesium anode as illustrated in Figure 1.

CORRECT THREAD ROOT RADII. The undesirable stress concentration characteristics of threads can be minimized by careful forming of the radius specified at the roots of all drill collar threads. It is obvious that sharp corners at the roots would aggravate the stress concentration. Further, correct thread root radii are necessary if the cold working process is to be effective. Correct and incorrect forms are shown in Figure 2.

CORRECT MAKEUP TORQUE. The most frequent cause of premature failure in drill collar joints was improper makeup torque. Insufficient torque allowed the joints to run loose, causing early fatigue failure of the pin, often in a matter of a few hours. Excessive torque may cause, (1) excessive static stresses in both box and pin, (2) actual rupture at thread roots of pins with ultimate failure in the hole, or (3) complete failure in the rotary table before the joints are even run. Some operators achieved correct makeup torque simply by supervision and training of crews. This was most often possible by using a rope on the makeup cathead. Other operators obtained correct makeup torque with instruments designed for the purpose. An example of these devices is shown in Figure 3.

USE OF STRESS RELIEF GROOVES. The removal of metal from stressed parts for the purpose of reducing the level of stress concentrations is a well known and established engineering practice. It has been applied to some degree to drill stem elements for 15 or 20 years. However, it was only about two years ago that the type grooves shown in Figure 4 were first applied to drill collars by a major drill collar manufacturer. Such grooves divert the lines of stress away from the thread roots where they normally tend to concentrate. Because of its smooth surfaces, the groove does not set up as high stress concentrations as the thread roots do, even though the total wall thickness of the box or pin has been reduced.

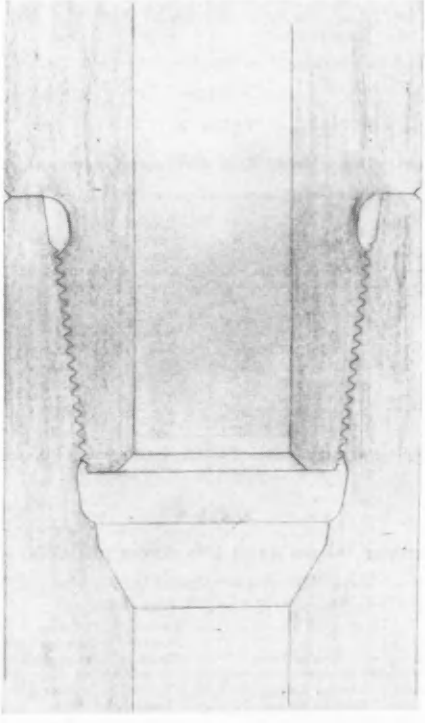

FIGURE 4. Drill collar joint with stress-relief grooves. Note how threads have been removed and undercut at principal stress zones of both box and pin.

Although utilization of stress relief grooves is still in its development stage, results were very encouraging on the rigs considered here. The results of the laboratory tests on grooves of this type were published[1] only recently.

Tables 1 through 4 show what combinations of practices drilling operators used to produce the joint performance they obtained. Table 1 shows the factor, or combination of factors, which resulted in joint life less than 1000 rotating hours. This is very poor performance. The only factor which alone caused such poor performance was incorrect makeup torque. In other cases it appears that a combination of things were required to produce such performance.

Table 2 indicated that at least one thing was not done in accordance with best practice to limit life of joints to 2000 rotating hours.

Generally good practices were used to achieve the life of 4000 hours indicated in Table 3. Several points become evident. The 4½-inch API full hole joint, which was only useful for 1000 hours before, has been raised to the 4000 hour level simply by the addition of stress relief grooves. Corrosion control was used in every case

where the 4000 hour level was reached, except the one where boxes had relief grooves. The only joints without cold worked thread roots to reach this level of performance are those with stress relief grooves.

Table 4 lists only those operators who reached 6000 hours or more. This is considered very outstanding performance and means that the average life of the joints was 12 wells or more. Note these points of interest.

- Every operator was using the recommended size joint for the drill collar.
- Rotary speed was limited in all cases.
- Correctly formed thread roots were used in all cases.
- Cold worked thread roots were used in all cases.
- Torque control instruments were used by 4 of the 7 operators listed. Those not using instruments had achieved correct makeup torque through training and supervision.
- Magnesium anodes were used to protect boxes from corrosion in all cases but one. In this particular case a stress relief groove was used in the boxes, eliminating

TABLE 1

Operators' Practices Where Joint Life Averaged Less Than 1000 Hours

Example	General Design	Rotary Speed	Thread Form	Cold Worked Thread Roots	Torque Control Instrument	Corrosion Control In Boxes	Remarks
A	4¾"x2"—3½" Int. Flush	80—110	Correct Root Radii	No	No	No	Poor Design. Note very weak box.
B	5½"x2¼"—3½" Int. Flush	70—100	Sharp Roots	No	No	No	Poor Design. Small Joint for this Size Drill Collar.
C	5⅞"x2¼"—4½" Xtra Hole	70— 90	Correct Root Radii	No	No	No	Poor Design. Note comparatively weak box.
D	6"x2¼"—4½" API Full Hole	70—100	Sharp Roots	No	No	No	
E	6"x2⅞"—4½" API Full Hole	70— 90	Correct Root Radii	No	No	No	Poor Design. Note excessive bore.
F	6"x2¼"—4" Full Hole	70— 90	Sharp Roots	No	No	No	Excessive make-up Torque.
G	6"x2¼"—4" H-90	80—120	Correct Root Radii	Yes	No	No	Drilled 1700' of 11" Hole each Well.
H	6"x2¼"—4" H-90	80—120	Sharp Roots	No	No	No	
I	6¼"x2¼"—4½" H-90	80—100	Correct Root Radii	Yes	No	No	Not sufficient make-up Torque.
J	6½"x2¼"—4½" H-90	80—140	Correct Root Radii	Yes	No	No	
K	6¾"x2¼"—4½" H-90	70—,90	Correct Root Radii	Yes	No	No	Not sufficient make-up Torque.

TABLE 2

Operators' Practices Where Joint Life Averaged Approximately 2000 Hours

Example	General Design	Rotary Speed	Thread Form	Cold Worked Thread Roots	Torque Control Instrument	Corrosion Control In Boxes	Remarks
A	6"x2¼"—4" H-90	70—100	Sharp Roots	No	No	No	
B	6"x2¼"—4" H-90	70— 90	Correct Root Radii	Yes	No	No	Excessive make-up Torque.
C	6"x2¼"—4" H-90	80—120	Correct Root Radii	Yes	No	No	
D	6"x2¼"—4" Full Hole	70—100	Sharp Roots	No	No	No	Excessive make-up Torque.
E	6"x2¼"—4½" Full Hole	60— 90	Sharp Roots	No	No	No	
F	6¼"x2¼"—4½" Xtra Hole	70— 90	Sharp Roots	No	No	No	

TABLE 3

Operators' Practices Where Joint Life Averaged Approximately 4000 Hours

Example	General Design	Rotary Speed	Thread Form	Cold Worked Thread Roots	Torque Control Instrument	Corrosion Control In Boxes	Remarks
A	5½"x2¼"—3½" Internal Flush	70—100	Correct Root Radii	Yes	Yes	Yes	Poor Design. Small Joint for this Size drill collar
B	6"x2¼"—4½" API F. H. Relief Grooved	70— 90	Sharp Roots	No	Yes	No	Note Relief Grooved Pins and Boxes.
C	6"x2¼"—4" Full Hole	70—100	Correct Root Radii	Yes	Yes	Yes	
D	6"x2¼"—4" H-90	80—120	Correct Root Radii	Yes	Yes	Yes	
E	6"x2¼"—4" H-90	70— 90	Correct Root Radii	Yes	Yes	Yes	
F	6¼"x2¼"—4" H-90	70— 90	Correct Root Radii	Yes	No	Yes	
G	6¼"x2¼"—4½" Xtra Hole	70— 90	Correct Root Radii	Yes	No	Yes	
H	6½"x2¼"—4½" Xtra Hole	70— 90	Correct Root Radii	Yes	Yes	Yes	

TABLE 4

Operators' Practices Where Joint Life Averaged 6000 Hours or More

Example	General Design	Rotary Speed	Thread Form	Cold Worked Thread Roots	Torque Control Instrument	Corrosion Control In Boxes	Remarks
A	5¾"x2¼"—4" Full Hole	60— 90	Correct Root Radii	Yes	Yes	Yes	
B	6"x2¼"—4" H-90	55— 70	Correct Root Radii	Yes	No	Yes	
C	6"x2¼"—4" H-90	55— 80	Correct Root Radii	Yes	No	Yes	
D	6"x2¼"—4" H-90	60— 90	Correct Root Radii	Yes	Yes	Yes	
E	6¼"x2¼"—4" H-90	60— 90	Correct Root Radii	Yes	Yes	No	Boxes only had Relief Groove.
F	6½"x2¼"—4½" H-90	60— 90	Correct Root Radii	Yes	No	Yes	
G	6¾"x2¼"—5" H-90	60— 90	Correct Root Radii	Yes	Yes	Yes	

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the thread roots normally protected by the anode.

It should be mentioned that none of the operators who obtained good performance used the collars listed for drilling the 1700 feet of 12¼ or 11-inch hole required for the salt string casing commonly used in the Canyon Reef area. Drilling large diameter hole with small diameter collars invariably results in shorter joint life.

The newest of the techniques discussed, use of the stress relief grooves, was still in the development stage when these data were compiled. Although this technique has not been evaluated fully, it seems possible that the design will permit many additional operators to achieve the 6000 rotating hour level of drill collar performance.

The procedure of periodic inspection of drill collar joints has proved economically desirable not only in savings of fishing jobs and operational costs, but also in maintaining collars at minimum shop cost and with minimum loss of collar length. It permits proper evaluation of the cause of drill collar trouble and assures fast remedial action.

This procedure, together with high quality shop practice and good field supervision, will obtain the greatest benefit from the new techniques discussed here.

REFERENCE

[1] "Methods for Improvement of Drill Collar Joints Evaluated by Full Size Fatigue Tests," L. E. Trishman, Southwestern District Meeting API, March 6, 1952.

About the Author

STANLEY C. MOORE received a B.S. degree in mechanical engineering from Rice Institute in 1937 and was employed by the Hughes Tool Company immediately thereafter. He served in various engineering capacities in the Gulf Coast area and South America and prior to his resignation in 1949, he was assistant to the vice president of engineering for Hughes. After leaving Hughes he formed the Drill Collar Service Company in Midland. Moore has authored several papers for the ASME, API and the AAODC.

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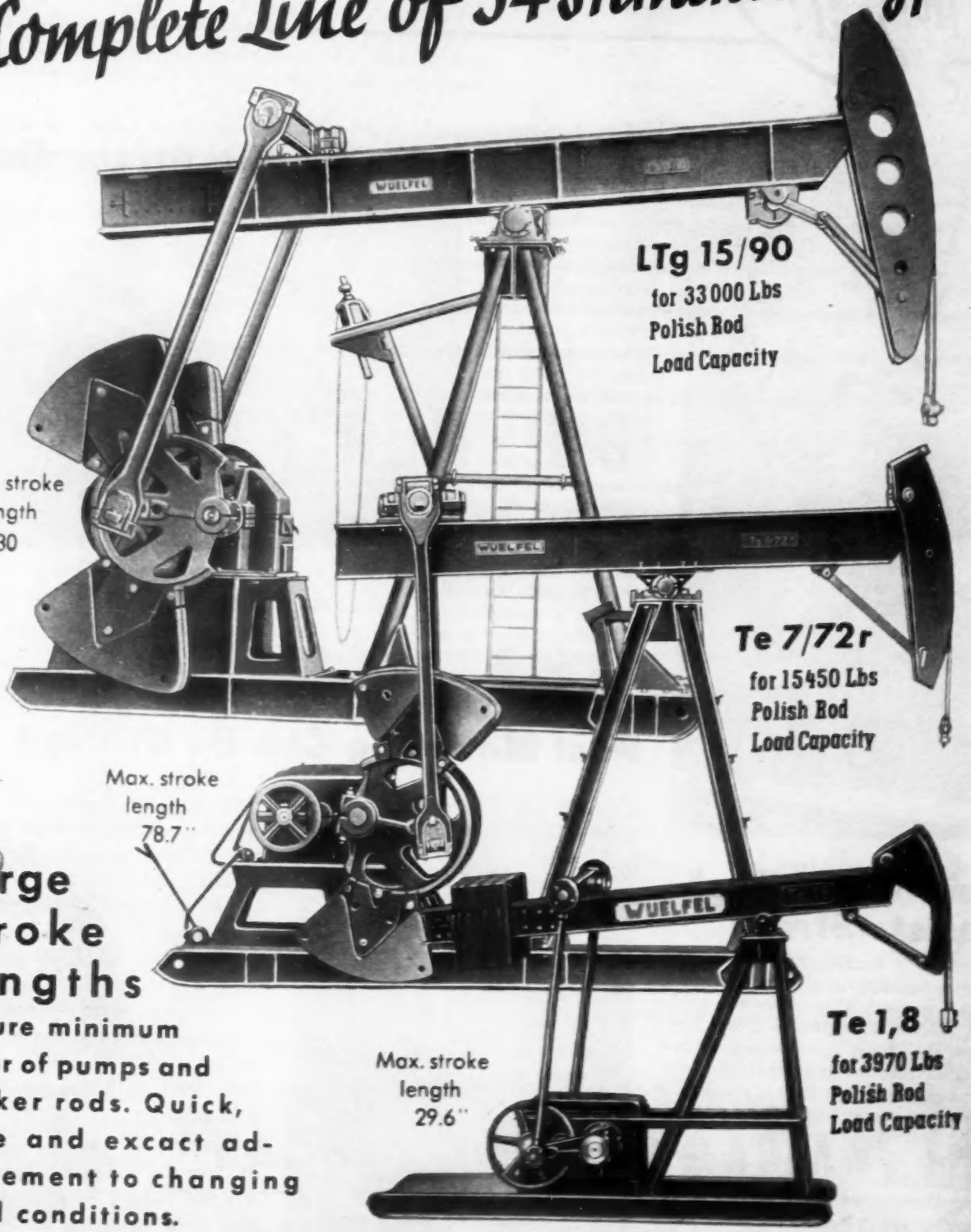

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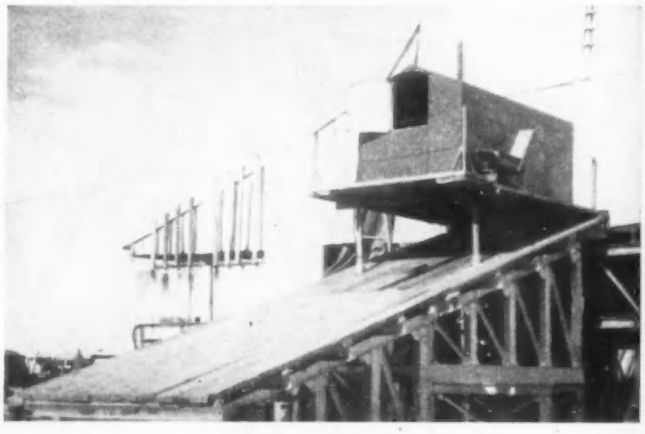
Reinforced Post Resists Strain

Because a considerable amount of force is exerted on the post when a sheave is used to pull at an angle with the cat line when skidding tools about the floor, or bringing heavy material from the ground at an angle, the lower end of the post is reinforced with a connection to the bottom sill of the derrick substructure.

A loop is welded to the structural steel member at a point immediately below the end of the post to anchor a turnbuckle, a piece of chain and a connecting hook. A few turns of the turnbuckle holds the post securely against the floor of the derrick. This apparatus will prevent equipment from tearing loose and injuring some of the men on the floor.

Tool House Operations Streamlined



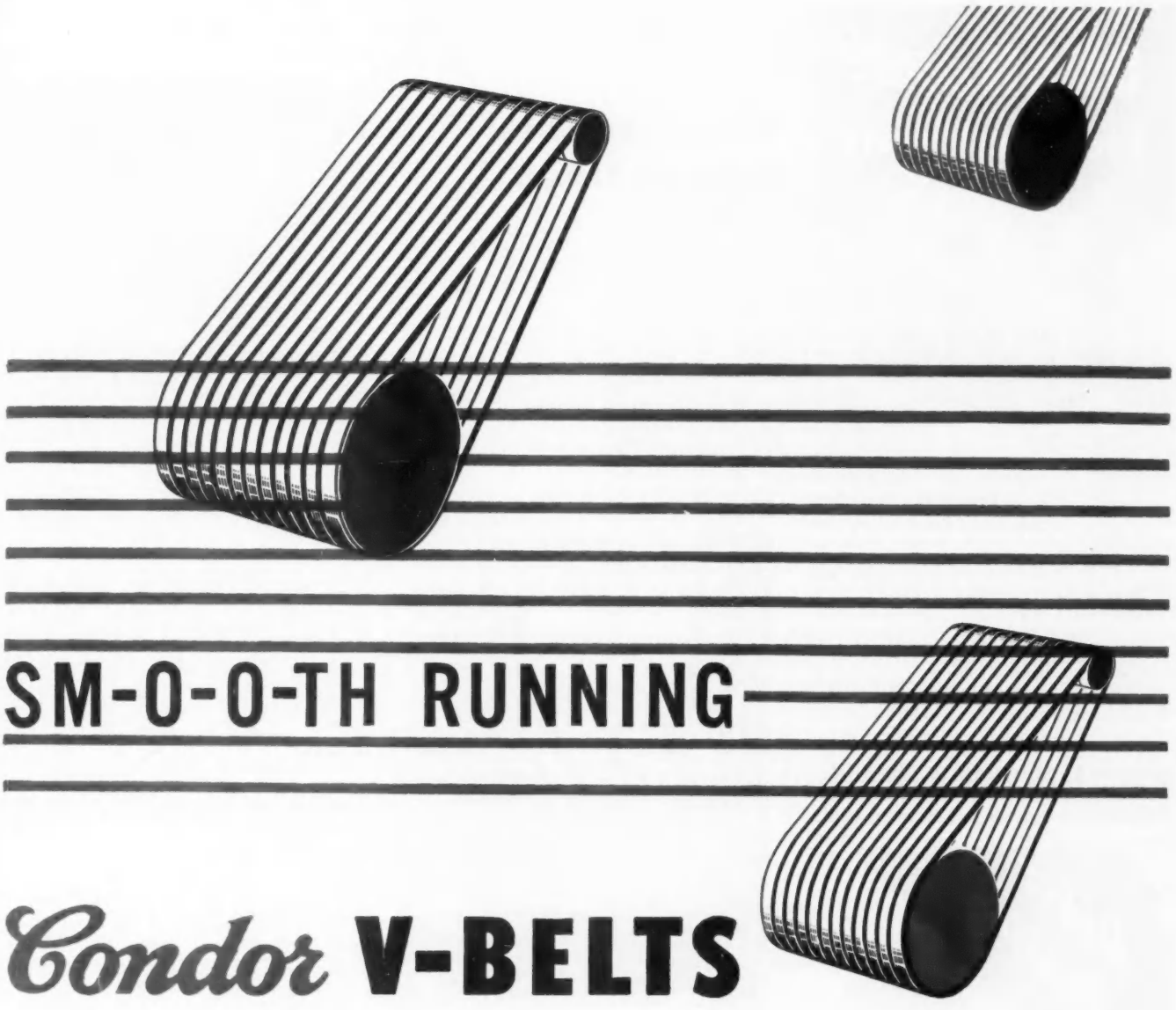
It is sometimes practical on drilling rigs to leave the loading ramp in place during the entire operation. When such is the case, the ramp provides an excellent means of mounting the tool-house at derrick floor level. The ramp eliminates the need for an elaborate tool-house substructure and also facilitates erection and removal.

The photograph shows the simplicity and convenience afforded by this arrangement. A relatively light removable framework is made of discarded drill pipe, the long leg sections being inserted into pipe sockets welded to the ramp framework below the floor level.

Post Mounting Can Be Utilized

The high line backup post pictured combines unusual strength with utility. The post is several feet in from the outer end of the walk and is made up of two lengths of drill pipe joined together at a tool joint which is just below the floor level. The lower, fixed portion of the post is an integral part of the rack, being welded to horizontal members, top and bottom, and braced in two directions just below floor level by horizontal lengths of drill pipe.

Spotting the post a short distance in from the end of the walk provides a small landing area on which men can work when equipment is being moved to or from the truck bed. Being able to dismantle the post by unscrewing the joint helps save rig time when moving to a new location.



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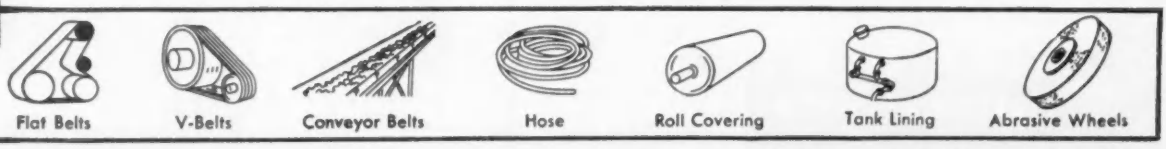

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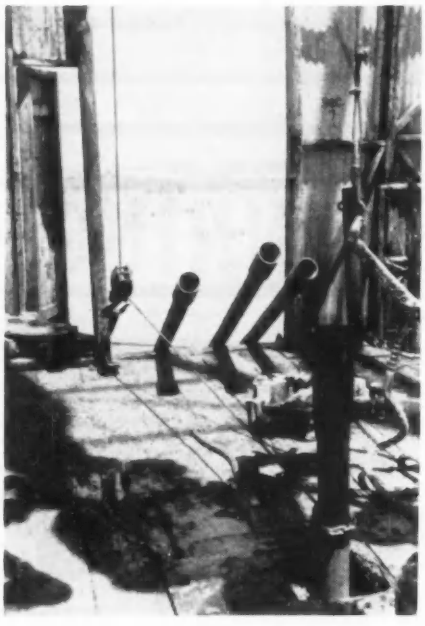
Mousehole connections will be speeded if a snatch block is rigged to run the derrick line over to a single in the mousehole. Just before the connection is made, a strain is taken on the single in the mousehole so that it will be easier to stab the kelly.

Aside from making the operation faster, connection work becomes safer since the joint of drill pipe is held rigid at all times.



Wire Under Pipe Preserves Floor

Many times where long strings of drill pipe are used it is necessary to reinforce the derrick floor where the pipe is to be racked with wooden planks.

After use, however, the planks become chewed and worn. By covering the planks with steel wire the wearing can be avoided.

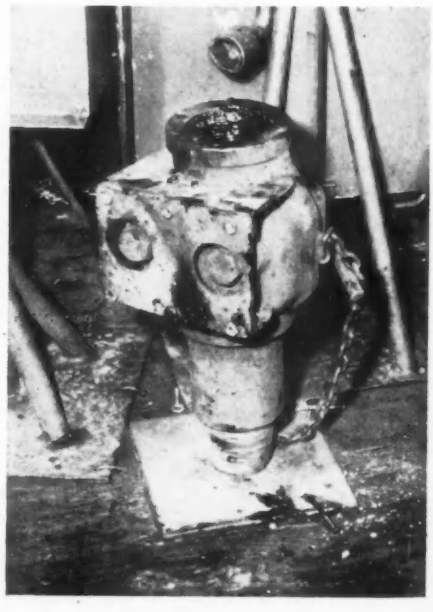
A substantial base on which to set drill pipe when racking in the derrick can be made by fastening several lengths of wire rope parallel to each other to large planks secured to the derrick floor. Steel mesh can be placed over the rope mat.

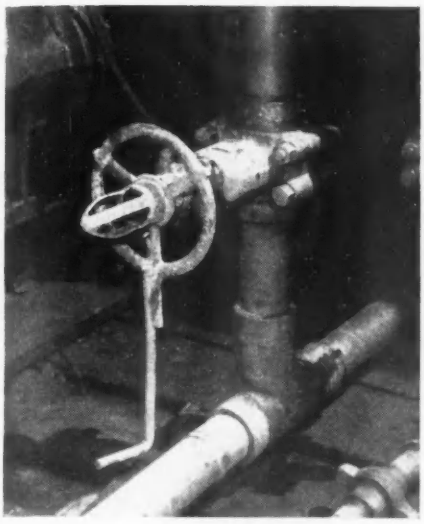
Rack Locates Safety Valves

A prerequisite to deep well drilling is that a safety valve be kept on the rig floor. Although the equipment is seldom used, when an emergency need does arise it is essential that all crewmen be familiar with its exact location.

To insure the convenient and known location of the safety valve, one operator made a stand of a square of plate metal to which a short one-inch nipple was welded. Holes perforated in the base plate permit anchoring the stand to the floor with nails.

By anchoring the valve stand near the indicator box, its location becomes well known to all crewmen. If the safety valve is required for emergency use, no delay will result from having to search the rig to find it.





Valve Handle Eases Operation

Mud and high pressure valves present a problem in operation since they are often difficult to adjust. In many cases, it is necessary to use a pipe wrench to handle valve adjustment.

To speed valve operation and make the job easier for crewmen, one operator welded a three-eighth inch rod handle to the valve wheel. With this simple addition to the valve wheel, it is relatively easy to adjust and snub the valve closed when necessary.

Rack Keeps Lift Plugs in Order

When lift plugs are used to handle pipe, it is essential that they be located at a convenient spot on the derrick floor. In turn, it is helpful when they are racked in a manner where they can be picked up without delay. The illustrated rack, which is made of two-inch pipe, plate metal and strap iron, will serve the purpose and can be put at any point on the floor.

Building the rack consists of first cutting six one-foot lengths of two-inch pipe and welding them to a 2 x 4 foot sheet of quarter-inch plate metal. The individual plug racks can be made of either strap metal or cut-out sections of five-inch pipe. These retainers are then welded atop the plate metal surface.

Inexpensive and simple to build, the unit will speed handling lift plugs during trips and, when not in use, the rack will make it easier to keep the plugs all together.

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Backup posts are a hazard on the rig floor unless they are properly secured. To be certain that the post would not rip out when in a strain, one operator rigged the unit with a long section of seven-inch casing.

Depending upon the substructure height, the casing section should be cut sufficiently long to extend about four feet above the floor and reach a point near the base of the structure.

The top of the section is capped and three-eighth-inch rod ears are welded near the top to serve as retainers for the tong line. Another rod retainer is welded near the base of the post to eliminate the possibility of the lower anchor line sliding upward.

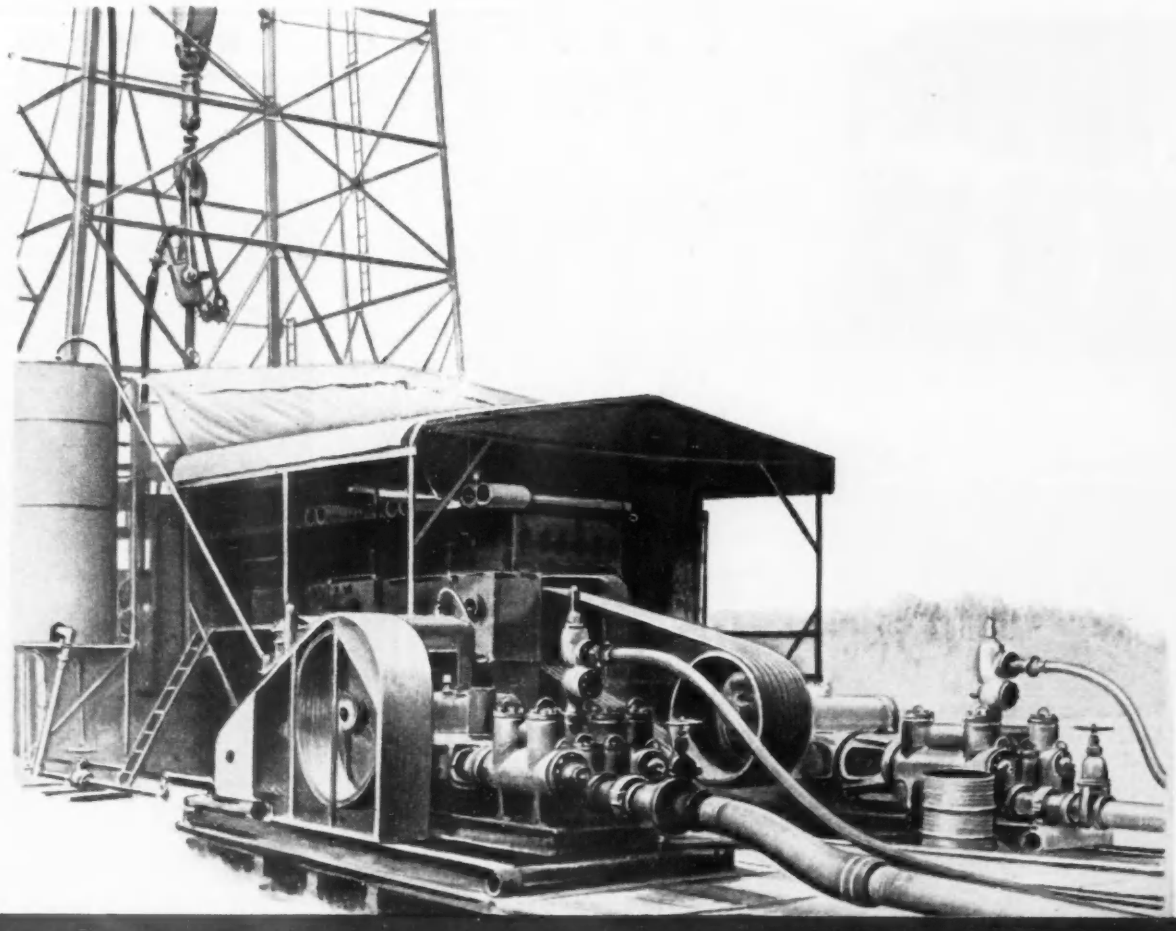
A five-inch casing support, cut and welded in a diagonal position, is placed near the top of the pipe segment. A square of quarter-inch plate steel is welded to the bottom of the diagonal brace to anchor the support to the derrick floor.

Although the post is cumbersome to move because of its length, the added insurance provided by the long, well anchored post, is a safety factor well worth while in rig operation.

Blowout Control Built Into Rig

The blowout preventer control panel is usually an independent unit placed at a handy spot on the derrick floor; however, on rig moves the panel is just another piece of equipment to handle. To overcome having to handle large quantities of independent equipment, one operator anchored the blowout preventer manifold in the substructure sill with extension handles reaching up to the floor.

Except for the extension handles,



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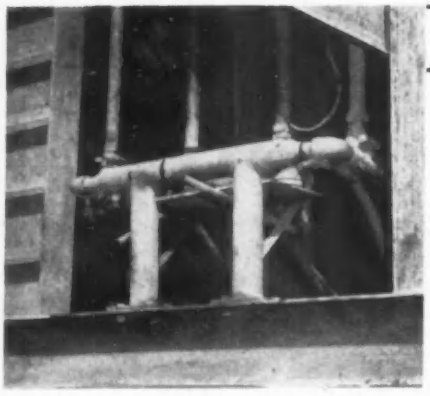
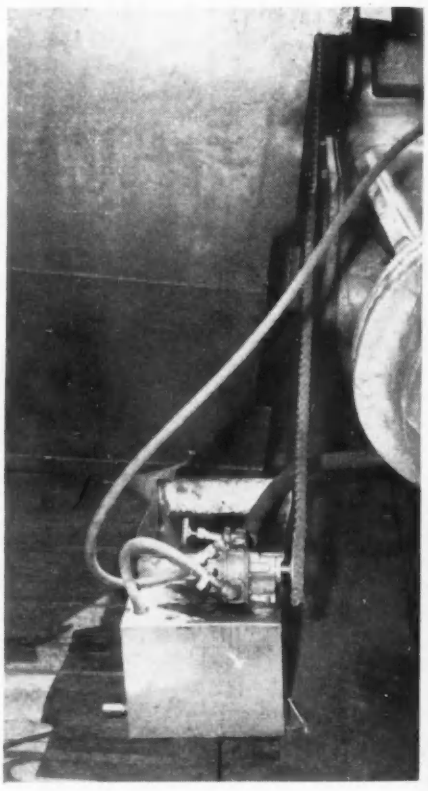
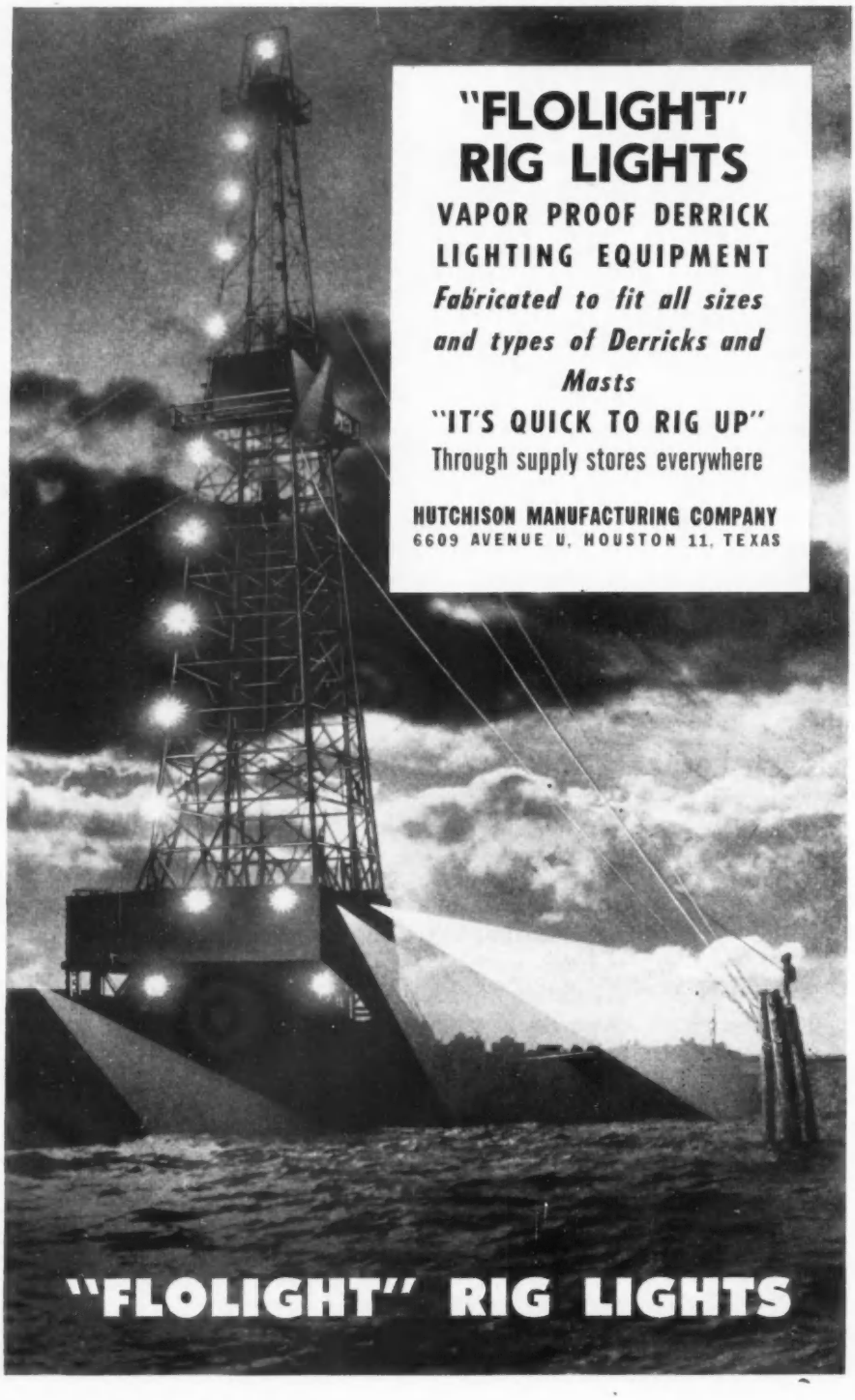


no special equipment is required for the installation and it is unnecessary to touch the manifold when the rig is moved. Another advantage is that the manifold, in the illustrated position, is safeguarded from damage by heavy equipment swinging on the derrick floor. At the same time, a few more feet of derrick floor are cleared for more convenient working conditions.





Portable Pump Keeps Rods Oiled

A small, belt-driven, centrifugal pump bolted to a metal reservoir will circulate an adequate stream of oil over the mud pump rods and guarantee extended rod life. The illustrated unit, although efficient, does not need a special pump drive pulley or expensive equipment.

Initial construction includes forming a twin reservoir chamber of light gauge metal. The suction side is covered while the intake reservoir is open but rigged with a screen. Once the reservoirs are fabricated, the small pump is mounted atop the suction side while suction and discharge hoses are connected to and from the pump.

The rope drive is merely placed over the master pump drive shaft and the tank is nailed to the floor to restrict its movement.

Holes are tapped over each pump rod while another hole is drilled in the base to deliver oil back to the return reservoir.

Simple to construct and inexpensive in design, this unit will pay the operator added dividends in reduced mud pump rod costs.

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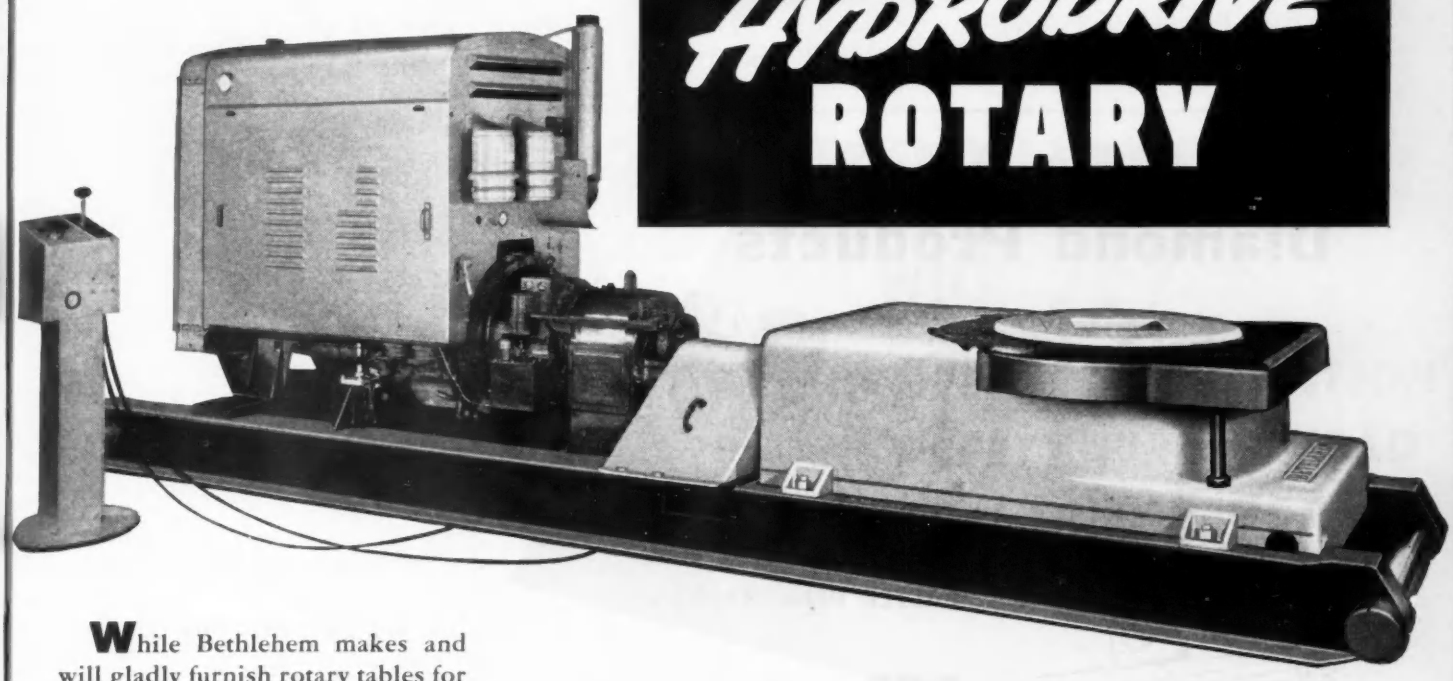

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The flexibility—"independence"—of Bethlehem's Hydrodrive tables makes possible great gains in your drilling set-up. For instance, there's reduced wear on the drawworks. There's complete control at the driller's fingertips. There's an infinite number of speeds from zero to maximum. With separate rotary drive, you are not draining power from the drawworks engines; more power, therefore, is available for the pumps.

Here are some other advantages: greater safety (no chain drives between drawworks and table) . . . more pipe-racking space . . . ready portability (fine for rathole digging) . . . drive and controls that make the units perfect for fishing.

Bethlehem Hydrodrive tables can be used at floor level or underneath the floor, whichever you prefer. And there are other features, too, that you'll want to investigate—because they mean an easier type of drilling. For full details, call or write the nearest Bethlehem Supply office.

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remains in a horizontal plane. The adjustable, or third, leg is a telescoping member, two-inch pipe extending up inside 2½-inch, which can be locked with a pin on any one of a half-dozen different positions.

Salvaged materials, for the greater part, are used in building such a unit. The base is made up of two lengths of channel iron arranged in a T position as shown. The pipe legs are attached to rotary chain links which provide the pivots at both top and bottom. Mounted on 8x8 timbers, the unit is sufficiently sturdy to withstand the rough service to which it is subjected and is transported easily between locations.

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Mud Guns Work By Lever Control

Adjusting submarine guns will become a simple matter when harp type handles are attached to the gun riser. These guns are rigged so the nozzles rotate through a 180-degree arch, thus assuring efficient agitation of drilling fluid near the mud tank base.

Packed and lubricated swivel joints are set in the riser below lip unions to permit easy adjustment of the nozzle direction. The handles are made of rod iron or sucker rods and the two lower ends are welded to the nozzle feed pipe below the swivel joint. The two pieces of round iron are separated to clear the fittings and remain in this position since horizontal braces have been welded in place. The top of the bars are ordinary pipe which are sleeved over the vertical extensions and can be removed for shipping. The upper ends of the pipe are tied together with a horizontal handle for convenient operation.

Here are some unique completion practices. Production pipe cemented in bottom of salt string, backed off with special casing backoff tool. And they're . . .

Saving 2800 Feet of Casing Per Well

By J. E. KASTROP
WORLD OIL Staff

LONG before the steel strike and casing shortage hit the industry in mid-summer, The Pure Oil Company had inaugurated completion practices in the Dollarhide field in Andrews County, Texas, that effected a saving of more than 45 percent of the production casing required per well in developing the Clearfork pay section. These unique completion practices were the outgrowth of efforts to improve producing characteristics of the several Clearfork pay zones, to reduce rig time formerly required in original well completions and to cut completion costs.

Current procedures may be described as being similar to setting a long liner from the top of the pay and extending up into the protection, or in this case, the salt string. Difference may be attributed to the use of a cementing circulating tool and casing back-off device placed in the string at the point to which cement will be placed. Above this point casing will be removed. What could be referred to as the liner section is not run in on drill pipe or tubing, but is run as a normal production string. The upper section is backed off and recovered. The pay section of the Clearfork is completed as open hole with total depth at approximately 6900 feet. Top of upper zone is found at about 6200 feet. Bottom of 5½-inch production casing is cemented at 6200 feet and backed off at about 2800 feet, requiring only 3400 feet of production pipe to complete a 6900-foot well.

Current Procedures

Although there are four producing horizons in the Dollarhide field, three of these are almost fully developed. These are: the Devonian at 7500 feet to 8100 feet, a two-zone horizon including about 200 feet of pay; the Silurian at about 8600 feet, and the Ellenburger at 10,000 feet. The Clearfork, the shallower of all four producing horizons, is generally found from 6200 feet to 6900 feet and includes five permeable zones of which at least three are productive in most wells. Each zone is a tight lime and requires some form of stimulation. To date, acidizing has proven beneficial, and because of the developments in selective acidizing, it has been practical to open the entire Clearfork section rather than to isolate any one section.

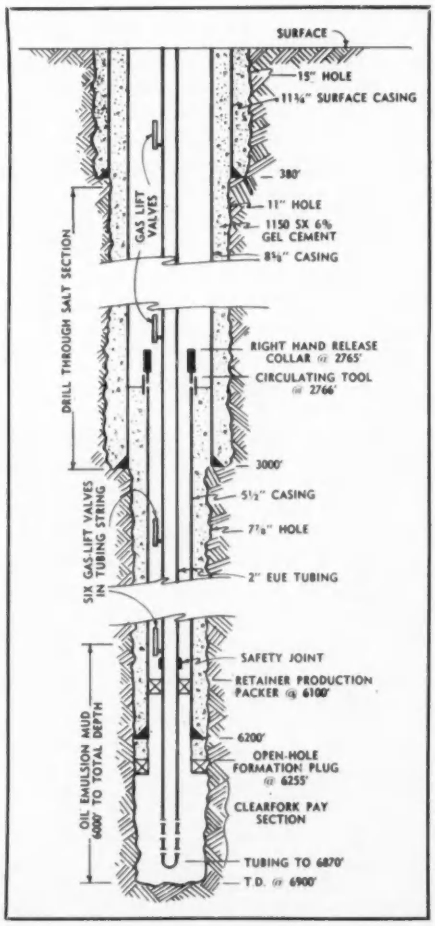

FIGURE 1. Typical well completion, Clearfork section, Dollarhide field.

Current drilling programs call for a 15-inch surface hole which is drilled with a bentonitic mud. Surface casing is 11¾-inch and is equipped with a float collar and guide shoe. It is set at about 380 feet and cemented to the surface.

A 11-inch hole is drilled to slightly more than 3000 feet through a salt section that requires a protective string of casing. This hole is drilled with a 32 percent salt-saturated mud. The salt string is of 8⅝-inch casing, equipped with float shoe and float collar, and is run in with centralizers. It is cemented from top to bottom with about 1200 sacks of 6 percent gel cement.

The cement plug is drilled out with a 7⅞-inch bit using water, and the hole is drilled in this manner to about 6000 feet. At this point, oil emulsion mud with a two cubic centimeter water loss is employed, and the hole is drilled through the pay zones in the Clearfork to about 6900 feet. Use of the oil emulsion mud has reduced bit wear and has minimized contamination of the tight lime sections.

A formation packer is run in on wire line and set just below 6200 feet and about two sacks of cement are dumped on top of it. The 5½-inch production string is equipped with a float guide shoe on bottom, two float collars, each placed at successive joints above the float shoe, and reciprocating centralizers and scratchers. The production string is equipped with a differential valve circulating tool at about 3400 feet from bottom, and immediately above this tool is a right-handed casing backoff tool.

Casing is then run to within a few feet off bottom and the pipe flushed with about 10 barrels of caustic and

quebracho water. This is followed with 550 sacks of 6 percent gel cement mixed with 550 cubic feet of perlite. This mixture is used to combat a weak zone below the salt string that has resulted in some lost circulation problems. Behind this perlite mixture is pumped in about 125 sacks of neat cement. A rubber plug is placed on top of the cement and pumped down to about 5995 feet with mud.

A bomb-type plug is dropped in the casing to plug up the passage through the differential valve casing circulating tool. With this plug in place, the casing is pressurized to about 600 to 800 pounds and the circulating ports in the tool are opened. Mud is circulated for approximately ten hours during which time the cement sets. This operation removes any excess cement above the circulating ports in the casing.

The 8⅝-inch casing and the 5½-inch casing are then pressure-tested with 1000 pounds pressure for 30 minutes. The 5½-inch casing above the backoff tool is then unscrewed and pulled from the hole.

A 4¾-inch rock bit is run in to drill out the differential valve tool and run to about 5995 feet. The casing is again pressure tested with 1000 pounds pressure for 30 minutes. The cement plug is then drilled and the bit run to bottom to insure a clean hole.

A production retainer packer is run on wire line and set at about 6100 feet, and tubing run in the hole. The tubing string is equipped with a perforated joint on bottom which is bull-plugged. It contains a packer seating nipple, a safety release joint and six gas-lift valves. The tubing is used to wash out the mud from the hole and fill it with oil. It is then run to within 27 feet of bottom and seated on the production retainer packer. The well head is connected up and the well tested.

Clean Out Techniques

A significant step in reducing well completion expenses and in reducing future artificial lift installation costs includes placing gas lift valves in the tubing string so that they may be used for any future artificial lifting requirements. Most wells come in flowing, but since some of the recent Clearfork wells are edge wells that will need lifting in the near future, installation of these gas lift valves during the initial completion saves killing the well and pulling the tubing to install the valves at a future date. Their immediate use in Clearfork completions is to eliminate swabbing

FIGURE 2. Specially-made right hand release back-off tool for 5½-inch casing which permits removal of pipe above this joint.

the well in. The Dollarhide gasoline plant supplies dry gas at 600 pounds per square inch, and this gas is used to "jet" the oil from the tubing to bring them in or to clean them out following acidizing treatments. It has been estimated that the cost saved in swabbing wells alone pays for the gas lift units. In addition to this saving, the time required by the gas lift method to clean the well is only a fraction of the time necessary for conventional swabbing techniques.

Acidizing Procedures

The number of acid treatments per well varies depending upon the response obtained after each treatment. Wells normally come in flowing, but the rate is improved by acidizing.

If the well does not test more than ten barrels per hour upon initial completion the well is treated with 2500 gallons of straight acid over the entire Clearfork section. The most permeable zones are affected. The well is cleaned and tested.

If desirable results are not obtained a second acid treatment is made. This consists of 750 gallons of gel acid and 5000 gallons of 15 percent hydrochloric acid. Idea of the gel is to seal off the more permeable zones treated in the first stage. The well is cleaned and tested again.

Should the well fail to respond, a third treatment is made and consists of from 1000 gallons to 7500 gallons of straight acid. The last treatment is a combination treatment with 1250 gallons of gel and followed by 10,000 gallons of straight acid. Each job generally improves the producing rate until the expected production is attained.

Earlier Practices

In earlier completions as in current practices, the Clearfork section was allowed to produce from the open hole throughout all of the several pay zones. However, in drilling these sections, 5½-inch production pipe was set just above the pay and extended to the surface. A 4¾-inch rock bit was used to drill into the producing zones. Because of the reduced hole size, life of bits was short and drilling time per well was excessive. Before the improved methods of selective acidizing, it was normal procedure to test and acidize each zone as it was drilled. The completion program on some of these wells required as much as 30 days, which was about as long as it took to drill the well.

In order to reduce drilling time through the pay section and to increase the bore hole diameter through the open hole section, the entire well below the salt string was drilled with a 7⅞-inch bit prior to setting pipe. The production string, usually 5½-inch, was cemented at the top of the pay by means of setting a formation bridge plug to keep cement off the pay section. Disadvantage in this system was in mudding up the producing zones. By using the larger sized bits, greater bit life was gained and penetration rates increased to cut down the drilling time through the pay. The same acidizing program applied in this method of completion as was used in former completions.

Next step in developing the completion program to minimize costs was in cementing the 5½-inch casing up into the 8⅝-inch salt string, thereby saving about 2800 feet of production pipe per well. Use of gas lift valves in the tubing effected large savings in cleaning wells following acidizing and in helping them to commence flowing. Low water loss oil emulsion mud increased bit life, increased penetration rates and minimized contamination of the producing sections. Current completions in the Dollarhide field, through study and development of procedures have been reduced to a minimum in cost, and should provide the basis for effecting similar savings in much needed casing and consequently total well costs elsewhere.

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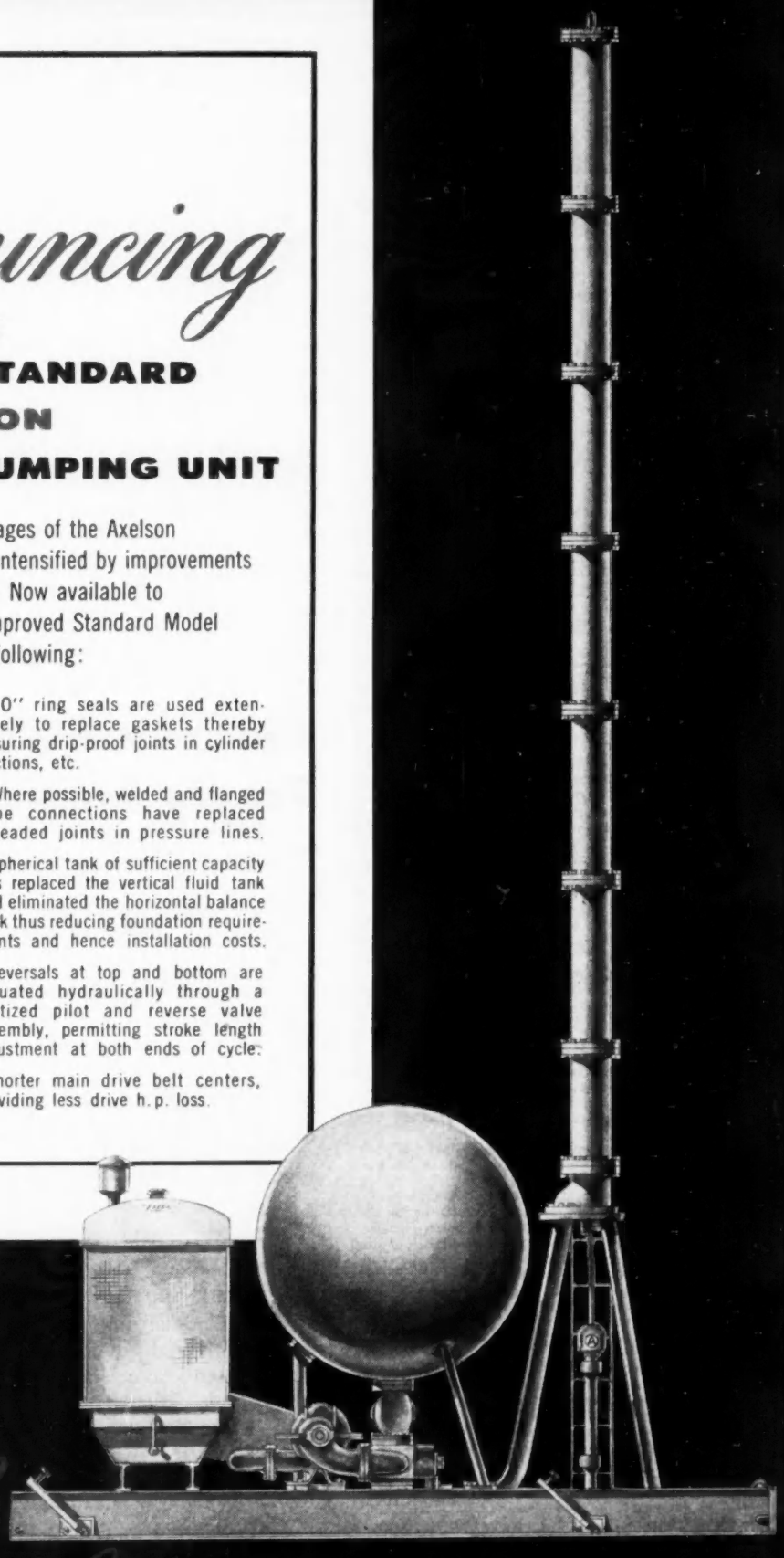

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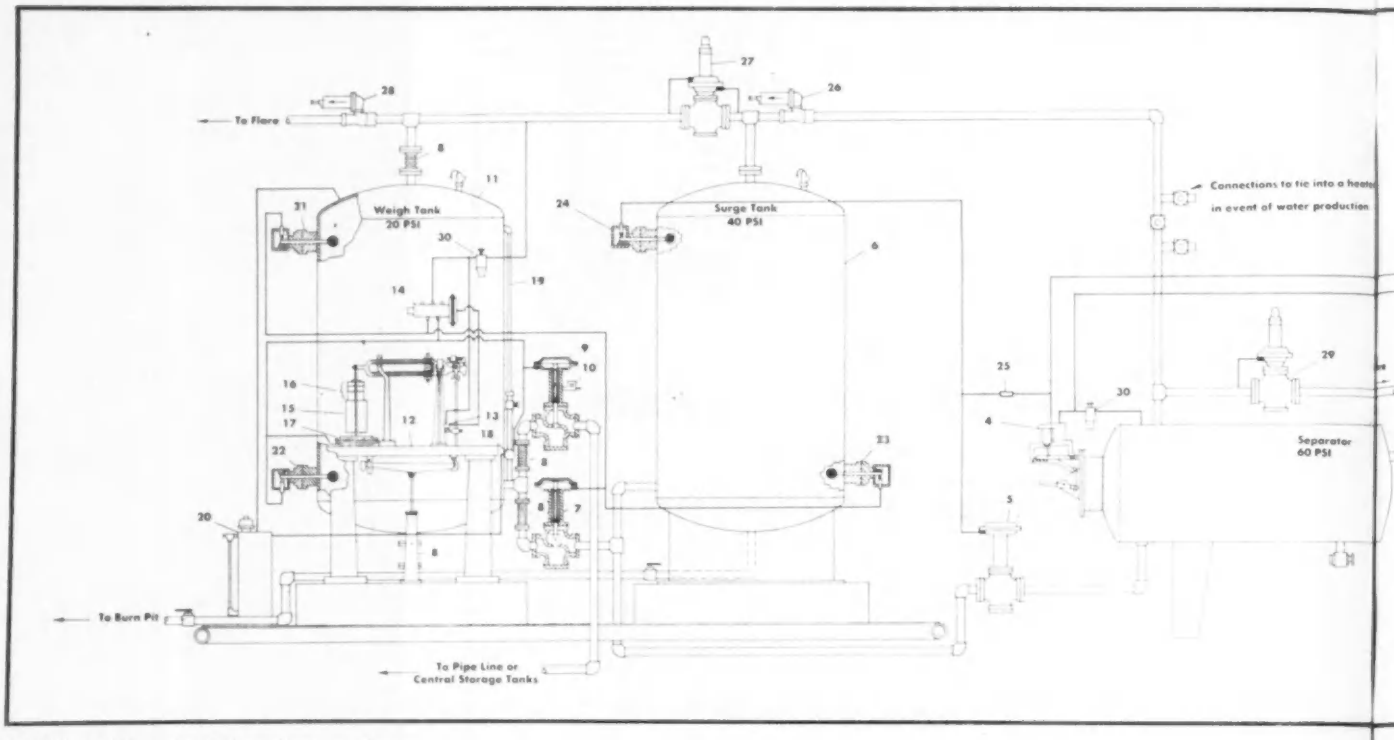


FIGURE 1. Generalized flow diagram of pneumatic hookup for automatic weigh tank system.

KEY TO NUMBERS

1. Two-inch diaphragm valve and pilot for well control from battery (pressure opening).
2. Two-inch diaphragm valve with reverse acting pilot to control fluid flow into separator (pressure opening).
3. 2½' x 10' 125 psi wp horizontal separator.
4. Pilot Valve.
5. Two-inch oil valve—separator dump valve (pressure opening).
6. Surge tank—4' x 6' welded steel tank—50 psi wp.
7. Two-inch oil valve—weight tank inlet valve (pressure opening).
8. Flexible connections—2".
9. Two-inch valve—weight tank outlet valve (pressure opening).
10. Cycle counter.
11. Weigh tank—4' x 6' welded steel tank—50 psi wp.
12. 60" x 48" platform, 6000# capacity, self contained floor scales.
13. Relay pilot from time cycle controller. Controls 4-way pilot valve No. 14. Operated by scale movement.
14. Four-way pilot valve. Diaphragm operated spring return. Controls inlet and out valves to weigh tank. Controlled by relay valve.
15. Counterweight for tare weight of weigh tank.
16. Moveable weights equivalent to 2500 lbs. on scale platform. Moved by diaphragm motor No. 17.
17. Modified diaphragm valve top. Pressure operated, spring return. Operated when pressure is applied to outlet valve of weigh tank.
18. Three-way pilot valve. Diaphragm operated, spring return. Controls sampling device. Operated when pressure is applied to outlet valve of weigh tank.
19. Sampler tube.
20. Sample accumulator.
21. Flextube liquid level controller—safety controller to shut weigh tank fill valve (No. 7) in event of excessive high fluid level.
22. Flextube liquid level controller—safety controller to shut weigh tank outlet valve (No. 10) in event of excessive low fluid level in weigh tank.
23. Flexible liquid level controller throttles weigh tank fill valve (No. 7) to maintain fluid seal in surge tank.
24. Flextube liquid level controller. Safety controller to shut separator dump valve (No. 5) in event of excessive high fluid level in surge tank.
25. Choke nipple to limit amount of gas to separator dump valve (No. 5).
26. Regulator to reduce separator pressure to desired pressure in surge tank.
27. Differential pressure controller to maintain desired differential pressure between surge and weigh tank.
28. Relief valve—to maintain desired back pressure on weigh tank.
29. Back-pressure gas valve — to maintain desired pressure on separator.
30. Pilot gas supply regulator and trap.

Automatic Weighing of Crude Oil Proves Accurate Volume Gauge

Here's how weights can be converted to volume at big savings in time and money.

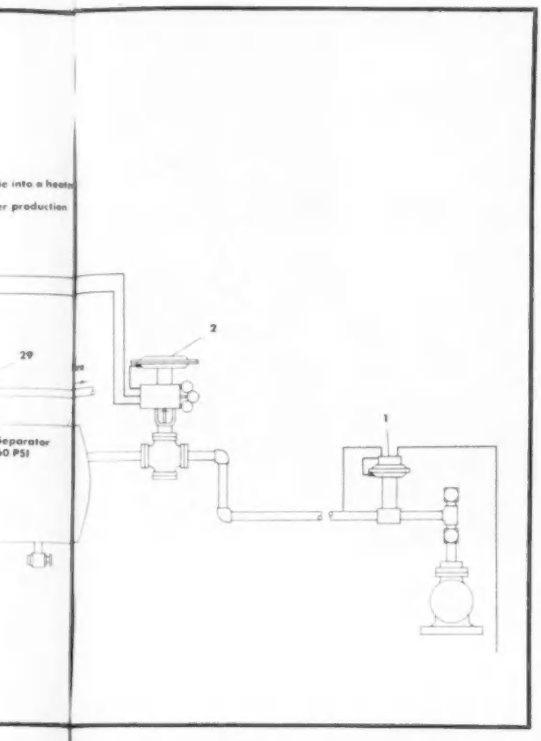
By L. E. SLAGLE and DOUGLAS C. MEYERS
Midland Area, Shell Oil Company

PROVEN IN field operation and in accuracy of measurement, a new automatic fluid weighing system makes it possible to determine volumes of live crude corrected to a standard temperature with savings in capital investment and with less physical effort from field personnel.

Called the "weigh-o-matic fluid meter," this system is a new approach to the problem of accurately measuring crude oil production in that it meters a predetermined weight of crude oil per cycle rather than volume. It has been found particularly advantageous where "live" crudes containing entrained gas are involved, since this small volume of gas is negligible compared to the weight of oil. Conversion to volume is accomplished by dividing the weight metered over a given period by the density of the oil. Its accuracy is unaffected by paraffin accumulations in vessels or by temperature variations of the crude. Table I is a summary of tests of this installation. Results were compared with a conventional battery to check accuracy of measurements. After measuring 3145 barrels of oil, an average difference in volume amounted to only 0.27 barrels, or 0.009 percent.

Basic Design

The "weigh-o-matic" system of fluid measurement installed in October, 1950 on the Turner-McKee Lease, Drinkard Field, New Mexico,



consisted of a conventional 2½-foot by 10-foot horizontal separator, a 4-foot by 6-foot surge tank and a 4-foot by 6-foot weigh tank mounted on a standard 6000-pound capacity, warehouse-type platform scale. Cost of the original installation, including cost of materials, labor to assemble and test, and labor to install at the location, amounted to $6,414 as compared to about $11,000 for a conventional battery to handle 500 to 750 barrels daily. Capacity of this automatic weighing system as designed and described here is about 1000 barrels of oil daily when the surge tank is used. When the surge or accumulator tank is not in use and fluid flowed directly into the weigh tank, capacity is about 500 barrels per day.

Enters Separator

Fluid and gas from one or more wells enters a conventional horizontal separator (Figure 1) after flowing through two control regulators, purpose of which is described later. Fluid dumps into a line connected into the surge tank and weigh tank. If the weigh tank is emptying, the flow is directed into the surge tank until the inlet valve on the weigh tank opens. When this valve opens, fluid enters the weigh tank until a pre-determined weight of fluid has been added to the tank. Then the inlet valve closes and the discharge valve opens, and fluid flows out of the weigh tank until this same pre-determined weight has been removed.

A representative sample of the fluid is caught from each cycle and stored in an accumulator so that the average gravity of the oil run can be measured later. A counter records the number of cycles during a given period so that the total weight of oil run in that period may be determined. By converting the corrected average API gravity of the oil sample to average density (pounds per barrel), the volume of oil run can be determined by dividing the total weight by the average density of the oil.

The weigh tank rests on the platform of a conventional beam type warehouse scale. Diaphragm valves are placed in the inlet and discharge lines and are controlled by a pilot valve which is actuated by movement of the beam. Weight of the tank plus the weight of the fluid left in the tank after each cycle is counterbalanced. With a counterweight equivalent to the desired weight to be run placed on the beam, the beam drops to its lower position. In this position, it actuates a pilot valve which, through a diaphragm-controlled, four-way relay valve, applies pressure to the inlet valve causing it to open and bleeds pressure from the discharge valve causing it to be closed.

Oil enters the tank until the added weight causes the beam to balance and thus move up from its lower position. This movement causes the pilot valve to be reversed which in turn reverses the four-way relay valve that closes the inlet valve and opens the discharge valve. When pressure is applied to the discharge valve, pressure is also applied to a diaphragm motor which lifts the counterweight off of the scale beam, causing it to move to its uppermost position. The beam remains in this position until the decreased weight, due to discharge of oil, causes the beam to balance. In moving down from its upper position, the beam trips the pilot valve, causing the discharge valve to close, the inlet valve to open, and the counter weight to be placed on the beam again. The cycle is then repeated. A counter actuated by the opening of the discharge valve records the number of cycles.

The sampler consists of a gauge glass on the side of the weigh tank, connected at the top to the gas space in the tank and at the bottom to the fill line to the tank. As the fluid level rises in the weigh tank, hydrostatic head forces part of the incoming fluid up into the gauge glass so that the level in the tank and the gauge glass is the same. Thus, a continuous sample is caught from the incoming fluid stream.

When the tank is filled to a predetermined weight and the discharge valve is opened, a diaphragm-controlled three-way valve in the line to the gauge glass is reversed, and fluid in the gauge glass flows by gravity into the sample accumulator which is maintained at the same pressure existing in the weigh tank. When the discharge valve is closed, the three-way valve is reversed again and the gauge glass is ready to catch another sample. A number of samples are stored in the same sample accumulator. Periodically, the accumulator is emptied and the average gravity of the oil run is determined from its contents. This is the only manual operation necessary for this automatic metering system.

Safety Measures

Each vessel is equipped with a high and low level safety device. Should a failure occur in the weight control mechanism and the inlet valve fail to close, the fluid level would then rise in the weigh tank until it reached the upper float which would cause the pressure to bleed off the inlet valve

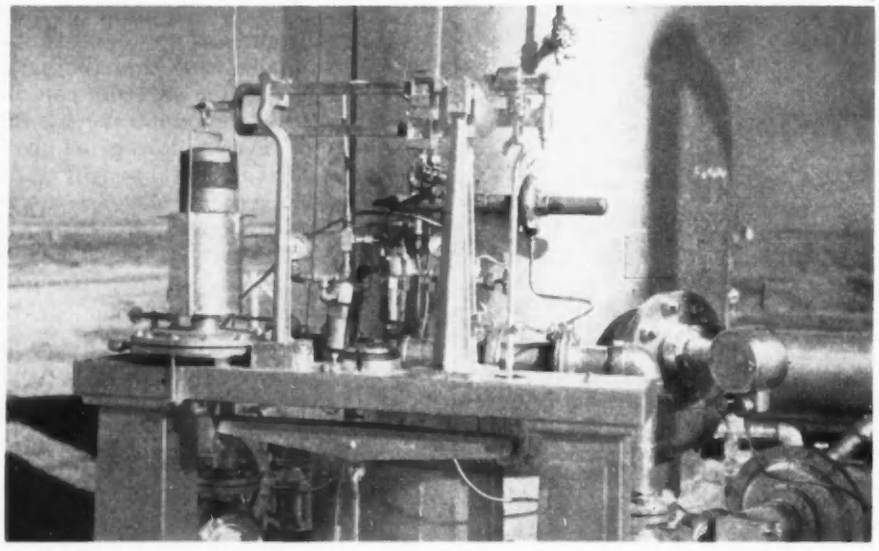
TABLE I

Field Test of Weigh-O-Matic Tank Battery

TEST No.	Date	Vol. Oil By Stock Tank Bbls.	Corrected API Grav. °API	No. Cycles	Wt./Cycle Factor	Vol. By Auto. Bat. Bbls.	Diff. in Vol. Bbls.	Percent Diff. %
*1	11/29/50	490.74	46.9	53	2542	491.40	+ .66	+.135
2	12/ 1/50	274.16	46.9	30	2542	274.74	+ .58	+.21
*3	12/ 3/50	489.06	47.1	53	2542	485.85	—3.21	—.66
*4	12/ 4/50	484.92	46.4	53	2542	483.90	—1.02	—.21
*5	12/ 6/50	434.38	45.5	48	2542	436.21	+1.83	+.42
*6	12/ 7/50	485.84	47.0	53	2542	485.46	— .38	—.08
*7	12/ 9/50	485.69	47.7	53	2542	487.50	+1.81	+.37
		3144.79				3145.06	+0.27	+0.009

* Pipe line run tickets totalled 2869.53 barrels, plus 0.2 percent BS&W = 2875.27 barrels.
Total automatic battery volume = 2867.56 barrels.
Difference = 7.71 barrels or 0.27 percent.

Side view of weigh tank supported on platform beam scales. Note sample accumulator at lower left which takes a representative sample from gauge glass on right of tank with each cycle.



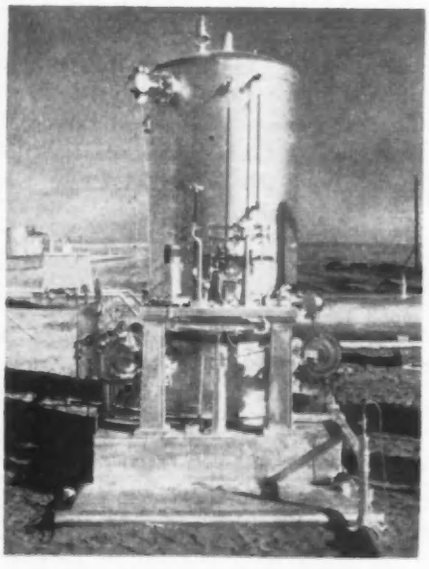
Closeup of beam scale arrangement showing method of suspension from the scale (below horizontal beam). Note flexible pipe coupling to minimize effect on slight tank movment to actuate scales.

causing it to close. Fluid would then fill up the surge tank until it reached the upper float in that tank, and the float control would bleed off the pressure from the separator dump valve causing it to close. The separator then begins filling and the float controlled pilot attempts to apply additional pressure to the dump valve. Due to a choke in the supply pressure to the dump valve, and the bleed off due to high level in the surge tank, the dump valve remains closed.

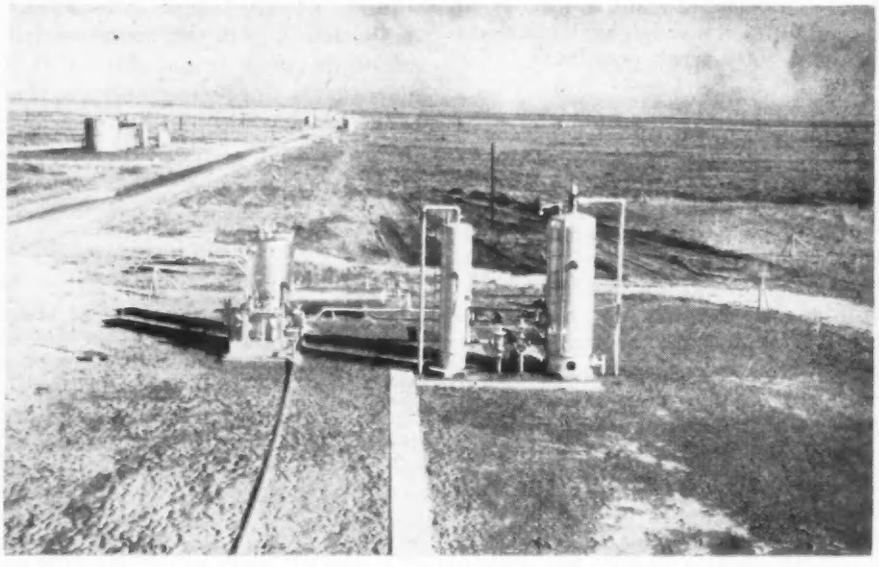
At a certain supply pressure to the dump valve, a reverse acting pilot begins reducing the pressure to the inlet valve to the separator. The supply pressure to the separator inlet valve is reduced to zero, thus causing it to close when a certain maximum supply pressure is supplied to the dump valve. With the separator shut in, the well flow lines build up pressure. A pilot-controlled valve at the well shuts in the well at a pre-determined flow line pressure. When the trouble is corrected, the various valves again will automatically open as the fluid levels and pressures drop to normal. The low level controls work in a similar manner, but are used primarily to provide fluid seals above the vessel outlets to prevent the escape of gas into the fluid lines.

This tank battery utilized pneumatically-controlled valves exclusively not because of their design or cost, but to test the reliability of pneumatic controls and also because electricity is not always economically available to all leases.

Should electricity be available, it would be a simple matter to substitute electrical controls for the pneumatic ones described above. A satisfactory electrical control system has been designed. A magnet-operated mercury switch, actuated by the movement of the scale beam, controls three-way solenoid valves which



General setup of weigh tank, showing horizontal separator in background at right. Behind weigh tank is accumulator tank.



Overall view of tank battery setup employing automatic weighing system at left. Both vertical separators at right are not associated with weigh tank system.

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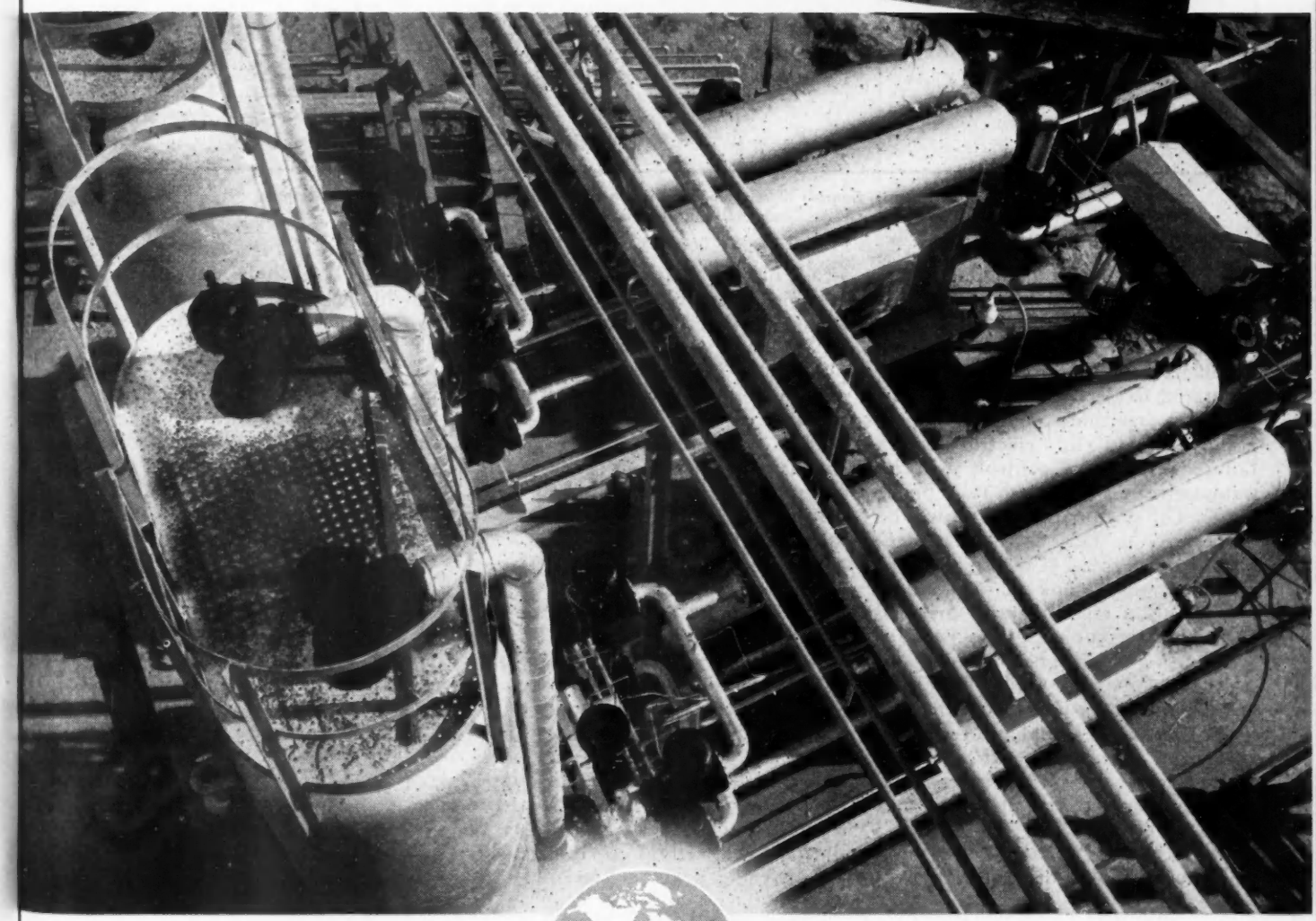

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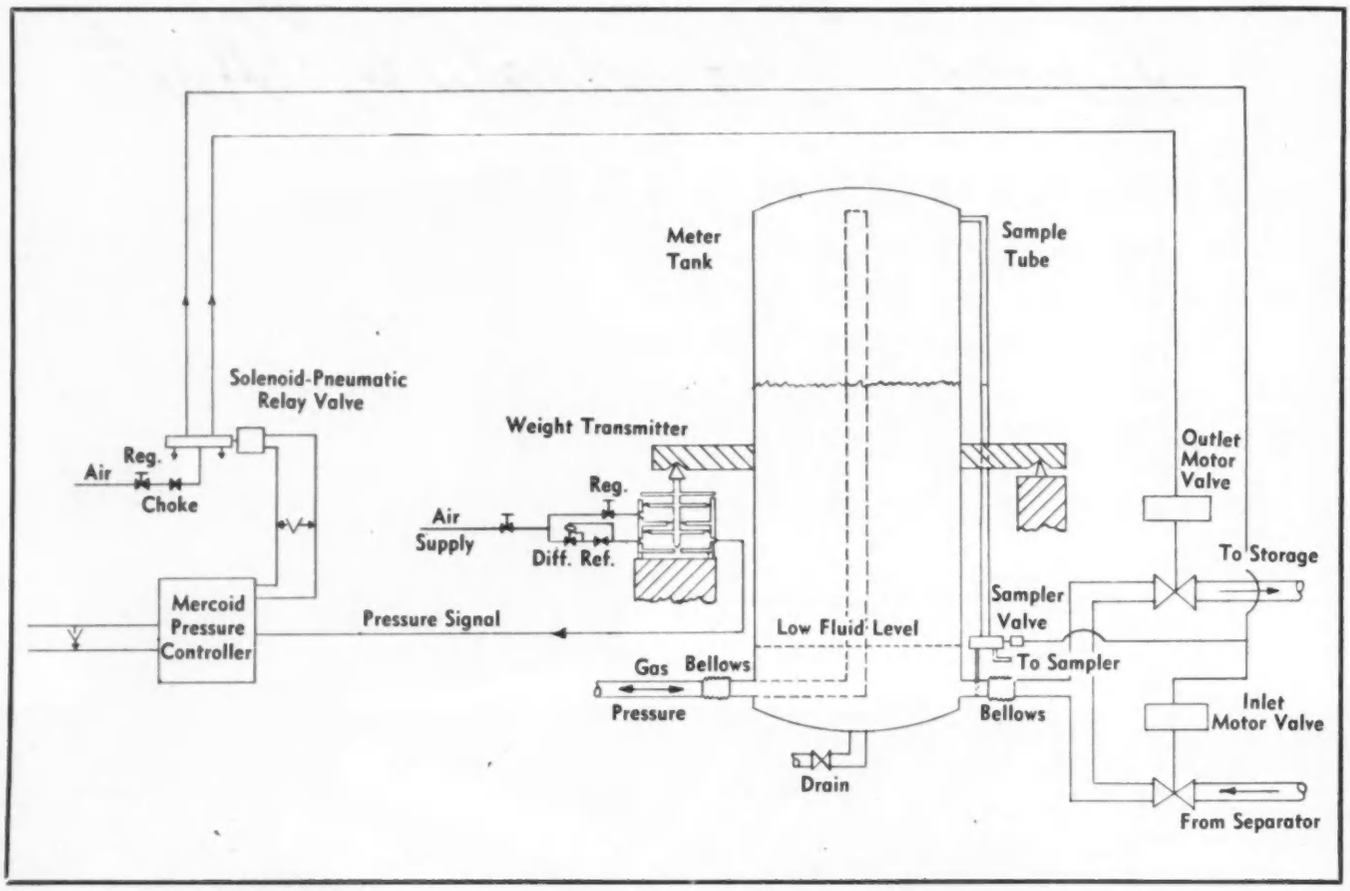


FIGURE 2. Schematic diagram of recommended improvement of weigh tank controls employing air cell and electric controls.

in turn control the main pneumatic diaphragm operated inlet and discharge valves. Pneumatic motor valves were retained due to their simplicity and rapidity of closing as compared to electric motor valves. In order to continue metering operations, should an electric power failure occur, the controls will be automatically switched to fully pneumatic. The pneumatic controls will be inoperative so long as there is electric power. Provision is also made so that the weigh tank may be filled, under only a few ounces of pressure to satisfy present pipe line requirements or under higher pressures in order to conserve gravity. In either case, fluid is discharged from the weigh tank by gas under pressure. A three-way pneumatic gas valve will be used to control the pressure within the weigh tank during its filling and emptying cycles.

Pneumatic Weight Transmitter

Another development of the automatic weighing system is offered by the use of a pneumatic weight transmitter to replace the warehouse type beam platform scale. The same weight principle for measurement purposes will be the same, but a pneumatic load cell will be used instead of the platform scales. This possible improvement will not only reduce present costs but will reduce the bulk and weight making the complete unit easier to construct and maintain. Basic parts incorporated in this improvement will be a metering vessel, a pneumatic load cell or weight transmitter, a pressure recorder, a differential pressure recorder, a relay, a cycle counter, an inlet and outlet valve and sampler.

The metering tank will be supported as shown in Figure 2. A rigid beam will be attached to the tank at its vertical midpoint, one end of which will be supported on a knife edge and the other end will rest on a pneumatic weight transmitter.

The pneumatic weight transmitter will consist of two separate chambers, one on top of the other. The upper chamber, or tare chamber, is used to counterbalance the fixed weight of the tank while the lower chamber is used to indicate the net weight of the fluid in the weigh tank. Diaphragms in the tare and net weight chambers are connected to a shaft which supports the weight platform. A pressure regulator is manually adjusted to admit the amount of air pressure into the tare chamber to exactly counterbalance to the desired tare weight. The shaft supporting the weight platform and attached to the two chamber diaphragms, covers a bleed nozzle in the lower chamber. Air or gas pressure to the lower or net weight chamber enters through a differential pressure valve which holds a constant two pounds per square inch pressure drop across the restriction orifice by means of a preloading spring. This combination of valve and restriction acts as an automatic controller to maintain the air supply rate proportional to the exhaust flow rate through the bleed nozzle. At equilibrium, these flow rates are the same and the pressure in the lower chamber multiplied by the diaphragm area is exactly equal to the force exerted on the transmitter by net weight of fluid in the tank.

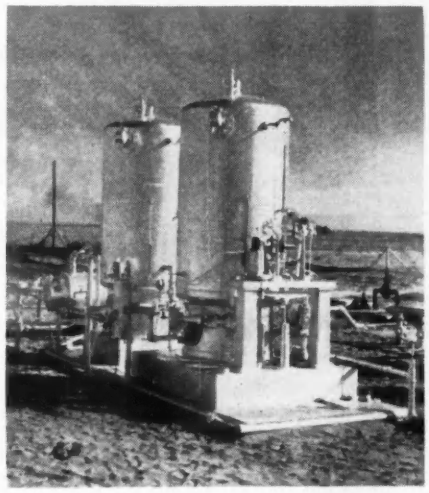
If the net weight increases, the additional weight causes the shaft and diaphragm to move toward the nozzle and throttle the flow of exhaust air. This throttling action causes the pressure to increase in the lower chamber and opens the differential valve until the increased pressure in the lower chamber causes exhaust flow out of the bleed nozzle to again be equal to the flow of supply air.

For a decrease in net weight of the

tank, the diaphragm and shaft move away from the bleed nozzle exhausting the air pressure faster than it can be supplied, which causes the differential valve to close until the reduced pressure in the lower chamber causes the exhaust flow to again become equal to the flow of supply air. A connection in the lower chamber will transmit the pressure signal to a remote indicator or controller. Ambient temperature variations will not affect the pressure in either chamber due to continuous bleed nozzles.

Fluid Controlled

By employing a differential pressure controller, the amount of fluid that enters and leaves the tank can be controlled automatically. It is planned to use a conventional mercury-type pressure controller with an adjustable pressure differential range. With the tank unloaded, the decreased pressure from the pneumatic weight transmitter will cause the pressure controller to energize an electrical circuit which in turn will actuate a solenoid-operated four-way pneumatic pilot relay valve which will close the outlet valve and open the inlet valve of the weigh tank. When the pressure signal corresponding to the weight of fluid added to the tank, increases to a predetermined pressure, the presure controller will snap open the electrical circuit to the four-way relay valve causing the inlet valve to close and the outlet valve to open. Fluid then drains out until the decreased weight and corresponding decreased pressure signal causes the pressure controller

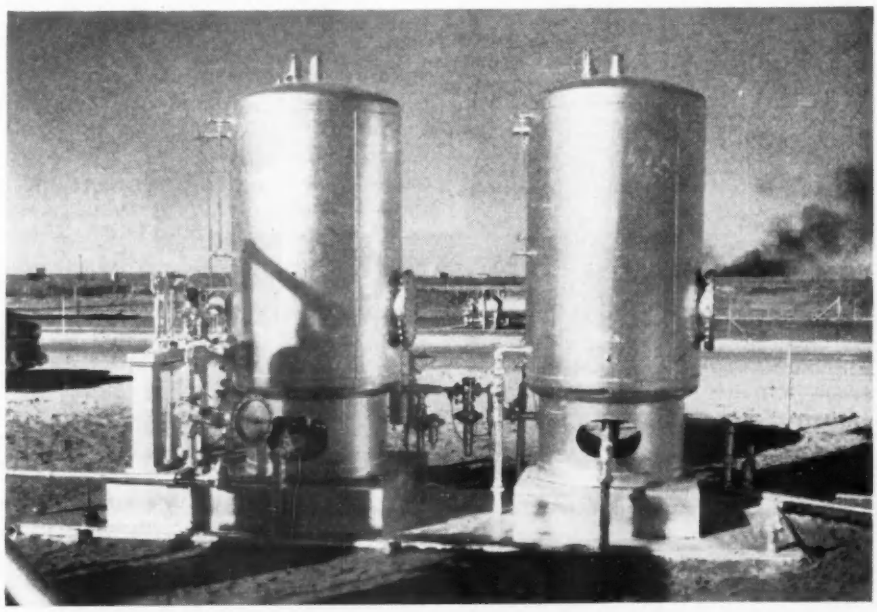


Both weigh tank and accumulator tank are mounted on common concrete foundation. This view shows the piping arrangement from horizontal separator in back to both accumulator and weigh tanks.

to again close the circuit to the relay valve which in turn closes the outlet valve and opens the inlet valve. The cycle is then repeated. A counter will be used to record the number of cycles.

Potential Applications

With the first successful design, construction and field operation of the "weigh-o-matic fluid meter" system of measuring crude oil volumes subsequent developments already planned and designed will increase its accuracy, its dependability, reduce costs of construction and maintenance. Its potential applications are broad, and not limited to oil field use alone. Under current design liquids may be accurately measured under pressure without exposing them to the atmosphere. It is possible to dump metered oil from the weigh tank directly into a field gathering system where crude from several batteries is collected for pumping into trunk lines. With a wide range of discharge pressures available with this method of metering oil, and depending upon the pressure available from the well, it is possible to flow the discharge oil for some distance from the weigh tank, or to discharge the oil into a pressured crude oil pipe line.



Side view of weigh tank, left, and accumulator tank, right.

About the Authors

DOUGLAS C. MEYERS attended Newark College of Engineering before enlisting in the U. S. Army during World War II. He was graduated from the University of Missouri in 1946 with a B.S. degree in mechanical engineering and joined Shell Oil Company. After completing Shell's standard training course, he was assigned to Odessa, Texas, as a mechanical engineer. Since March of 1950, he has been in Shell's Midland area office as development engineer.

L. E. SLAGLE is a graduate of Texas A. & M. College. He joined Shell Oil Company in 1943 in the Production department. He became a junior mechanical engineer at Houston in 1944. He later filled assignments at Midland and Odessa in the West Texas Division. In 1948 he served as mechanical engineer in the Hobbs District and the following year was named production foreman in the TXL field. He returned to Hobbs as district mechanical engineer in 1950. He was later named division mechanical engineer. He was recently named Northern Division production superintendent.

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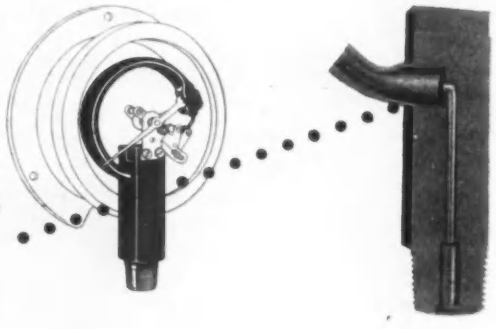

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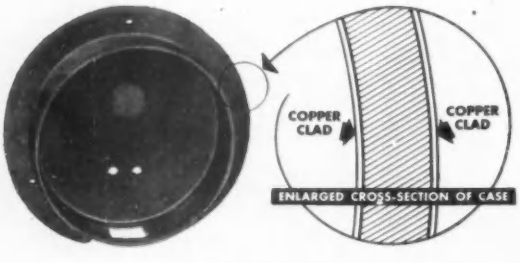

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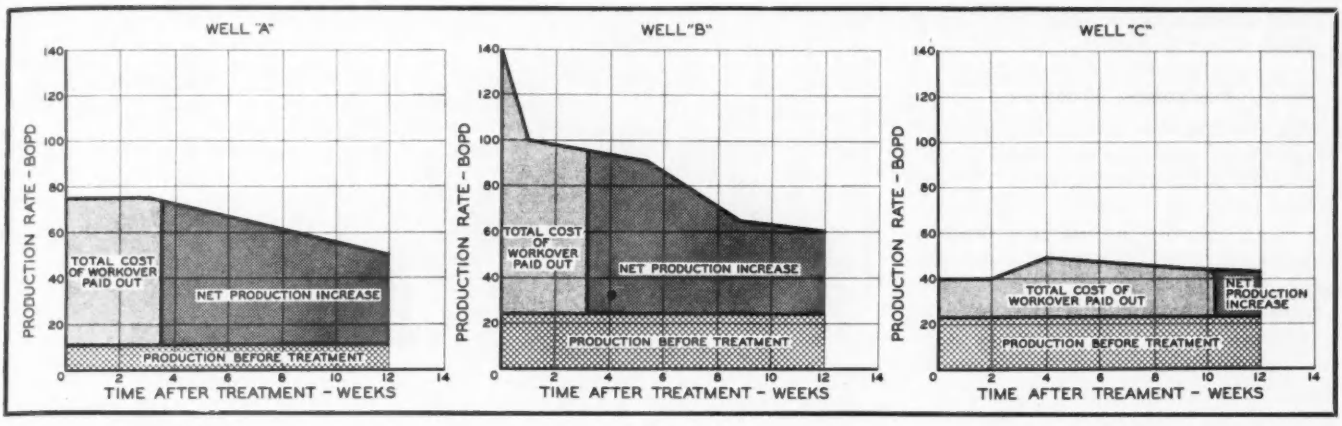

FIGURE 1. FIGURE 2. FIGURE 3.

Increased production on these wells paid out costs of fracturing treatments in few weeks, and resulted in substantial production increases.

Acid Gel Fracturing Increases Production

Recent results have been encouraging. Here are reports on new treatments.

By R. S. OUSTERHOUT and D. E. RAMSEY
Dowell Incorporated, Midland, Texas

RECENT developments in formation fracturing incorporating the use of a gel acid has proven successful in increasing production from sandstones, limestones, dolomites, conglomerates and cherts in the Permian Basin. Outstanding results have been obtained in treating the Grayburg formation in Ector County, Texas. Improvements in treating sand formations with fracturing fluids have stepped up drilling and workovers in this type sediment where limestones were previously predominant. Formation fracturing with gel acids have been used to increase production from the Yates, Delaware, Queens, Cisco and Spraberry sands in West Texas. These formations are from one percent to 50 percent soluble in acid.

The fact that many West Texas producing formations, with relatively high solubility, do not respond favorably to either nitro-shooting or acid treatment has been recognized for some time. This problem has been approached from several viewpoints.

Petrographic analysis, a study of thin sections of a formation under polarized light, has revealed some interesting and useful facts concerning the physical make up of formations. Although cuttings from a particular formation are largely acid soluble material, the formation may be put together in such a way that the soluble part is insulated by a non-soluble film. Formations which have vugular, fracture, or intergranular porosity occasionally have an insoluble film covering their exposed surface. If this film consists of silicate, sulfate, or heavy hydrocarbon deposits, conventional acid solutions will not remove it. Because such deposits are usually precipitated from fluids moving through the flow system of the formation, they will have a severe detrimental effect on the permeability of the medium. Efforts to restore or increase the permeability of such a formation should logically be directed toward reopening and interconnecting the natural flow system of the reservoir. The need for this type of treatment resulted in

FIGURE 4. No workover rig is required for fracturing treatment, high-pressure lines being hooked directly from pump truck into tubing valve at well head. Special type trucks are shown at left.

the development of the fracturing process.

Fracturing Medium

This formation fracturing method employs a smooth, pumpable kerosine-acid gel. It contains a special round grained sand, approximately 40 mesh, usually added in a proportion of three-quarters of a pound of sand per gallon of gel. This proportion may be reduced or increased to meet specific well requirements. This gel has sufficient body to carry the sand in suspension, eliminating the need of mixing at the well. An additional advantage is that no gel-breaker solution is required in conjunction with its use. Once it has been pumped into the formation, it thins of its own accord, returning readily to the well bore, as a thin, easy-flowing liquid after spending.

The gel contains various chemical agents which promote increased dissolving power for calcareous material, cement, petroleum residues, silicates and various clays or drilling mud residues that may be present in the formation. Special conditioning agents assure the return of the spent acid to the well bore, together with the kerosine, following the treatment.

This method of well completion accomplishes the following objectives:

- Extending natural fractures in the formation and propping them open with sand, providing a highly permeable medium to permit the uninterrupted drainage of oil into the well bore.
- Dissolving and cleaning out material within natural formation flow channels or fractures, or adhering to the walls of fractures.

Treating Technique

The fracturing gel is mixed and stored at a central mixing plant, and carried to the well in transports equipped with power-driven paddles which keep the sand evenly dispersed in the treating solution. Rig time and treating time are minimized as the treating solution is ready to pump into the well as soon as it arrives on location. Figures 4 and 5 are photographs taken during a fracturing treatment in the South Cowden field, Ector County, Texas. These pictures show the simple surface hookup required for the treatment. A hook-wall packer with hold-down tool above it had been set previously in the casing.

FIGURE 5. Heavy-duty, high-pressure pumps on two trucks in foreground pump sand-carrying gel from transports into wall.

Less than two hours were required to hook up and treat this well with 4500 gallons of the gel, containing 2250 pounds of Ottawa sand. One hundred barrels of oil were pumped into the formation behind the treating fluid as an after-flush to carry the sand away from the well bore. Following a brief shut-in period, to allow the forces set up by the treatment to reach equilibrium, the well was opened up and put on test. It produced 124 barrels of oil per day, flowing. Other wells in the vicinity have come in at 10 to 20 barrels natural, on completion.

Treating the Grayburg

Formation fracturing has been employed successfully in sandstone, limestone, dolomite, conglomerate and chert formations. Outstanding results have been obtained in treating the Grayburg formation in Ector County, Texas. Figure 6 shows the sample log of a typical Grayburg well in this area, indicating that the formation is predominantly dolomite with sand and anhydrite stringers and inclusions. Most of the wells in this area were shot with between 200 and 800 quarts of nitro-glycerine on completion. Production from the average well ten years old, or older, is about 10 barrels of oil daily. Efforts to increase production by re-shooting with nitro-glycerine have given some increases, while acidizing has produced only spotted results.

This method of formation fracturing was first used in the Grayburg formation in this area in April, 1952. Results of these early treatments were so encouraging that about 65 wells were treated during the next four months. Cost of the entire operation frequently has been returned to the operator in less than one month. Average pay-out time of the first three

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Something new has been added . . .

FORMATION fracturing incorporates a number of proven principles, as well as several new features, in its application as a method of increasing well production. In reviewing the development of conventional techniques, it is noted that nitro-shooting was probably the first successful method. The development and subsequent improvements in nitro-shooting techniques and efficiency of application is a familiar story in the oil industry. However this method, for the most part in recent years, has been limited to sandstone formations. For carbonate reservoirs, the technique of acidizing is probably the most successful treatment. These two methods have undergone many changes through improved application procedures, but basically they are quite similar to what they were 20 years ago.

Within recent years a new principle of well treatment has been developed which has evolved into several different processes of application. Basically, it involves the displacing of a viscous gel, containing a round grained sand, into the formation. The successful application of this new process to old and new wells has resulted in increasing not only the recovery rate, but the amount of recoverable reserves as well.

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treatments was less than 5½ weeks. After the investment had been returned, these wells produced an average of 51⅓ barrels of oil per day more than they did before treatment. As the lifting costs were not increased substantially, this extra production can be considered a 51 barrel dividend every day.

Production curves of these first three wells are shown graphically in Figures 1, 2, and 3. Table 1 lists the results of several additional fracturing treatments in this area, including both new and old wells. In the South Cowden field, all the wells completed since April have been treated by this method.

Sand Treatments

Improvements in treating sand formations with fracturing fluids have resulted in increased drilling and workovers in sandstones where limestones were previously predominantly productive. Production has been increased by fracturing treatments from the Yates, Delaware, Queens, Cisco and Spraberry formations which are from one to 50 percent soluble in acid. There is usually a concentration of acid-soluble material along the natural fractures and planes of weakness in the formation. The acid component of the fracturing gel is helpful in removing these deposits, as well as mud lost to the formation during drilling operations. The excellent sand suspending ability of the gel is extremely important when selectively treating with straddle packers, or when treating large shot holes where the fluid velocity is very low.

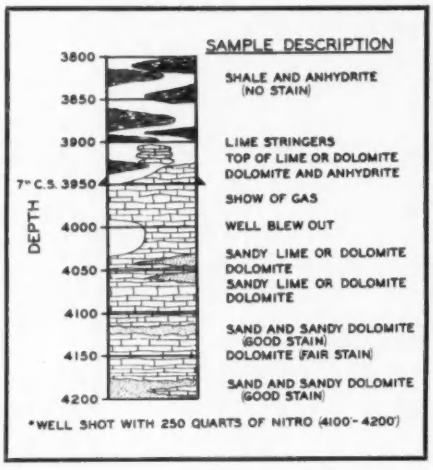
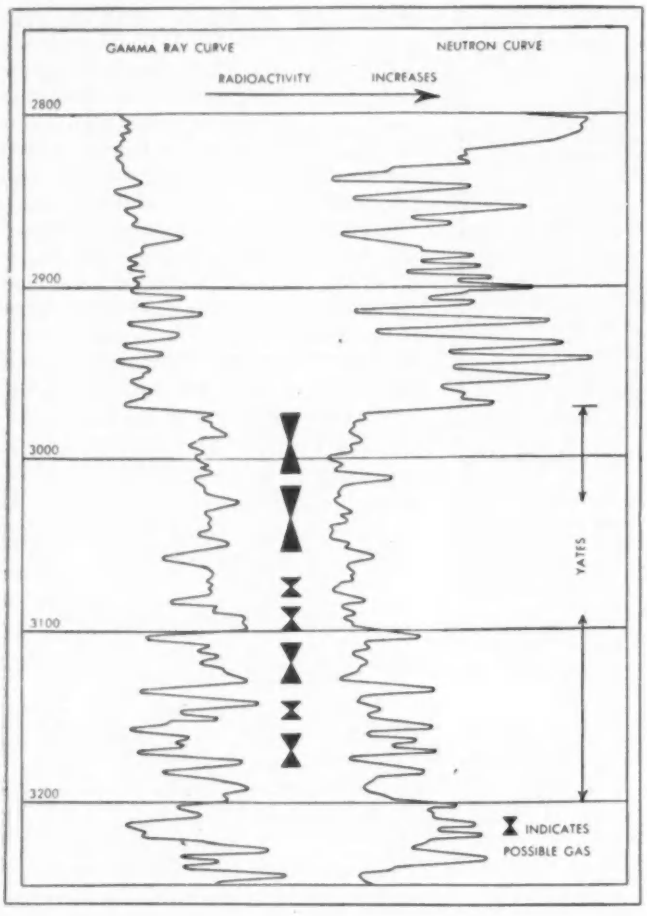


FIGURE 6. Sample log from typical Grayburg well in North Cowden field, Ector County, Texas. This well was completed in 1935, with original potential of 585 barrels of oil per day.

FIELD RESULTS

TABLE 1

Company and Well	County	Pool	Formation	Treatment Data	Results and Remarks
A Well 1	Ector	Johnson	Grayburg	Treated April 4, 1952—3000 gal. gel, 2250 lb. Sand. Max. tbg. press. 1900 psi. Below Baker retainer.	Old Well, previous treatment: Shot with 520 qts. Nitro on completion. Before treatment: 11 BOPD—After treatment: 76 BOPD + 18 BWPD—After 3 weeks: 76 BOPD + 18 BWPD—May 21, 1952: 65 BOPD and 10 BWPD—June 24, 1952 (after 12 weeks): 51 BOPD + 8 BWPD. Aug. 18, 1952: 25 BOPD.
B Well 1	Ector	North Cowden	Grayburg	Treated April 14, 1952—3000 gal. gel, 2250 lb. Sand. Max. tbg. press. 2300 psi. Below retainer.	Old Well, previous treatment: Shot with 424 qts. Nitro on completion—Before treatment: 25 BOPD, pumping—After treatment: Flowed 200 BOPD on ¾" ck.—After 2 weeks: Flowed 100 BOPD on ¾" ck. with 200 psi. tbg. press. July 14, 1952: About 45 BOPD.
B Well 2	Ector	Foster	Grayburg	Treated April 22, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1550 psi. Below H. W. Packer.	Before treatment: 23 BOPD—After treatment: 40 BOPD. May 4, 1952: Ran Echo-Meter, found fluid level at 1200', pull the pump—May 21, 1952: 50 BOPD—June 24, 1952: About 45 BOPD.
C Well 1	Crane	Dunes	San Andres	Treated May 3, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1800 psi. Below retainer.	Before treatment: 12 BOPD, Old Well—After 1 week: 27 BOPD After 2 weeks: 24 BOPD—After 3 weeks: 22 BOPD—After 4 weeks: 22 BOPD.
D Well 1	Ector	North Cowden	San Andres	Treated May 9, 1952—2000 gal. gel, 1000 lb. Sand. Max. tbg. press. 1300 psi. No packer in the hole.	New Well, before treatment: Swabbed 30 BOPD—June 24, 1952: 45 BOPD.
E Well 1	Ector	Donnelly-San San Andres	Grayburg	Treated May 11, 1952—5000 gal. Acid—2000 gal. gel, 1000 lb. Sand. Max. tbg. press. 2200 psi. Below H. W. Packer.	New Well, before treatment: Swabbed about 2 BOPD.—After treatment: Swabbed 45 BOPD—May 15, 1952: Pumped 40 BOPD.
F Well 1	Ector	Foster	Grayburg	Treated June 11, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1400 psi. Below H.W. Packer with H. D.	Old Well, Shot with 500 qts. Nitro—Original pot.: 708 BOPD—Before treatment: 8 BOPD—June 17, 1952: 82 BOPD—June 24, 1952: 74 BOPD.
G Well 1	Ector	South Cowden	Grayburg	Treated June 13, 1952—500 gal. Acid, 3000 gel, 1500 lb. Sand. Max. tbg. press. 2150 psi. Below H. W. Packer with H. D.	New Well, show of oil—After treatment: Pot. about 210 BOPD Above average for this area.
B Well 3	Ector	North Cowden	Grayburg	Treated June 14, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2350 psi. Below retainer.	Old Well shot with 400 qts. Nitro—Before treamtent: Pumping 25 BOPD—After treatment: Pumping 90-100 BOPD—June 24, 1952: 98 BOPD.
H Well 1	Ector	South Cowden	Grayburg	Treated June 13, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1750 psi. Below H.W. Packer.	Old Well shot with about 400 qts. Nitro—Original pot.: 92 BOPD Before treatment: 25 BOPD—June 18, 1952: Pumping 65 BOPD
I Well 1	Ector	Donnelly	Grayburg and San Andres	Treated June 15, 1952—5000 gal. Acid, 3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2350 psi. Below retainer.	New Well—30 BOPD Natural—June 24, 1952: 45 BOPD pumping. Average for the area.
J Well 1	Ector	Foster	Grayburg	Treated June 17, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1900 psi. Below H. W. Packer with H. D.	Completed 1937, Acidized with 5000 gal. Dowell X. Before treatment: 15 BOPD—June 24, 1952: Pumping top allowable 45 BOPD on 1¼" pump, 14-28" strokes per min. No re-potential.
A Well 2	Ector	Foster	Grayburg	Treated June 17, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1950 psi. Below retainer.	Old Well, shot with 455 qts. Nitro—Original Pot. 259 BOPD—Before treatment: 5 BOPD—June 20, 1952: 56 BOPD—June 24, 1952: 51 BOPD.
K Well 1	Ector	North Cowden	Grayburg	Treated June 21, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2200 psi. Below H. D. Packer.	Old Well, Nitro shot on completion. Before treatment: 5 BOPD pumping. After treatment: 120 BOPD flowing.
F Well 2	Ector	Foster	Grayburg	Treated June 27, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1200 psi. Below H. W. Packer with H. D.	Old Well, shot with 500 qts. Nitro—Original Pot. 508 BOPD. Before treatment: 8 BOPD—After treatment: 30 BOPD.
L Well 1	Ector	Foster	Grayburg	Treated June 28, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2700 psi. Below retainer.	Old Well, Nitro shot on completion. Before treatment: 12 BOPD. After treatment: 30 BOPD—After 2 weeks: 19 BOPD.
K Well 2	Ector	North Cowden	Grayburg	Treated June 28, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1650 psi. Below TIW Packer.	Old Well, Nitro shot on completion. Before treatment: 36 BOPD pumping. After treatment: 40 BOPD flowing.
I Well 2	Ector	Donnelly	Grayburg	Treated July 3, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2350 psi. Below retainer.	New Well, show of oil on natural test. After treatment: 25 BOPD 1 MMCF gas PD.
G Well 2	Ector	North Cowden	Grayburg	Treated July 3, 1952—1000 gal. Acid, 3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2150 psi. Below H. W. Packer with H. D.	New Well—1150' of free oil in hole. After treatment: 120 BOPD.
B Well 4	Ector	South Cowden	Grayburg	Treated July 7, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 2200 psi. Below H. W. Packer with H. D.	New Well, show of oil very poor section. After treatment: pot. 165 BOPD.
N Well 1	Ector	South Cowden	Crayburg	Treated July 9, 1952—3000 gal. gel, 1500 lb. Sand. Max. tbg. press. 1700 psi. Below H. W. Packer with H. D.	Old Well, shot with 480 qts. Nitro on completion. Before treatment: 1 BOPD. After treatment: 95 BOPD after 1 week.
N Well 1	Loving	Wheat	Delaware	Treated February 12, 1952—1500 gal. gel, 750 lb. Sand. Max. tbg. press. 1300 psi. Ave. inj. rate: 3.7 BPM.	New Well. Before treatment: Pumped 5 BOPD. After treatment flowed 49 BOPD on potential test. July 25, 1952: flowing 27 BOPD.
O Well 1	Loving	Tunstill	Delaware	Treated June 30, 1052—2000 gal. gel, 1000 lb. Sand	Old Well, Original potential—After Nitro: 130 BOPD. Before treatment: 20 BOPD. After treatment: 67 BOPD.



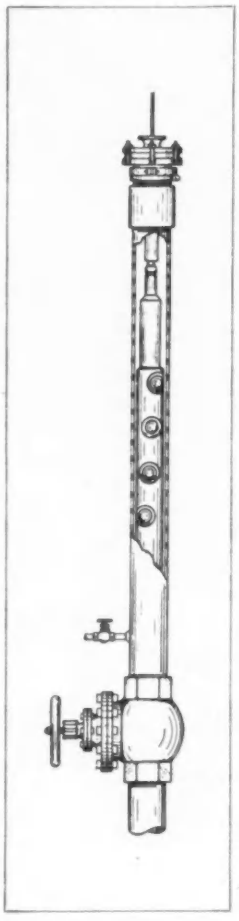


FIGURE 1 (left). Gamma ray and neutron logs of a cased depleted oil well indicating potential gas zones.

FIGURE 2 (right). Schematic diagram of method of lubricating perforating gun in casing during testing of each zone.

Unique completion practices used in Permian Basin to make . . .

Gas Wells From Depleted Oil Wells

By H. E. LITTLE
Lane-Wells Company, Los Angeles

INCREASING gas production in the Permian Basin by re-completing oil wells beyond the economic limit is on the upswing due in large part to a boost in price and a rising demand for gas. Natural gas transmission lines to the West Coast and an increase in the construction of natural gasoline plants are largely responsible for this high demand. The result is a closer evaluation of depleted oil wells for possible gas zones that could be productive.

Most widespread practice in the Permian Basin is to plug back depleted oil wells and perforate casing opposite the formations containing gas in commercial quantities. This method of increasing gas production has presented both operational and economic problems, since many well records are incomplete. During completion there was a tendency to change techniques and drilling practices, resulting in problems faced now.

Prime objectives, when the re-completion program is being organized, are to localize the sections of interest and perforate the casing in the desired intervals, affording a maximum flow of gas with minimum cost and time. Procedures incorporating radioactivity well logging and gun perforating have made possible economic and trouble-free completions.

Perforating the casing and sample testing the flow can be accomplished simultaneously and safely. A lubricating nipple with an outlet for an orifice well tester and a blowout preventer containing blank rams are installed at the surface on the well casing below the lubricating nipple. These precautions eliminate the necessity of maintaining a hydrostatic head of fluid in the casing since the blowout preventer and lubricating nipple give the operator complete control while perforating and testing under pressure.

Radioactivity Log Run

A radioactivity well log is run to select the desired intervals for testing. As indicated in Figure 1, the gamma ray curve picks the zones of possible production and the neutron curve pinpoints the productive sections within these zones. This registration of fluid content by the neutron curve, in the formations which the gamma ray curve has located and defined, eliminates exploration of dense formations or impermeable sections of the productive zones.

A selectively fired gun perforator affording maximum penetration and varied shot density is then used for the perforating and testing operations. A shot density of one per foot for initial tests of each interval is used. As the flow increases and pressure builds up, it is contained by an oil saver installed on the top of the lubricating nipple (Figure 2). After expending all loads in the gun perforator, the safe removal of the gun under pressure is accomplished by raising it into the lubricating nipple and closing the blowout preventer. The packing element can then be safely removed from the oil saver.

By noting the gas increase with the

▪ CONTINUED ON PAGE 270

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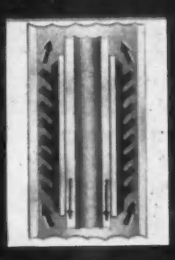
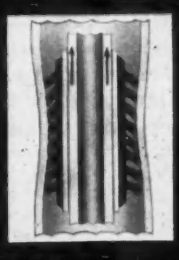
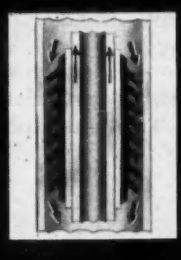


On the down stroke fins are in normal upturned position, allowing E-Z Swab to fall free.

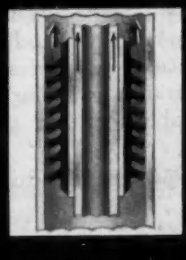
Flexibility of fins allows EZ Swab to pass smoothly through tight spots on up or down stroke.





E-Z Swabs automatically by-pass fluid overload. Each rubber will lift approximately 400 feet of fluid. Rubber fins bend down and unload excess fluid.

After overload fluid is passed, fins spring up and seal against tubing.



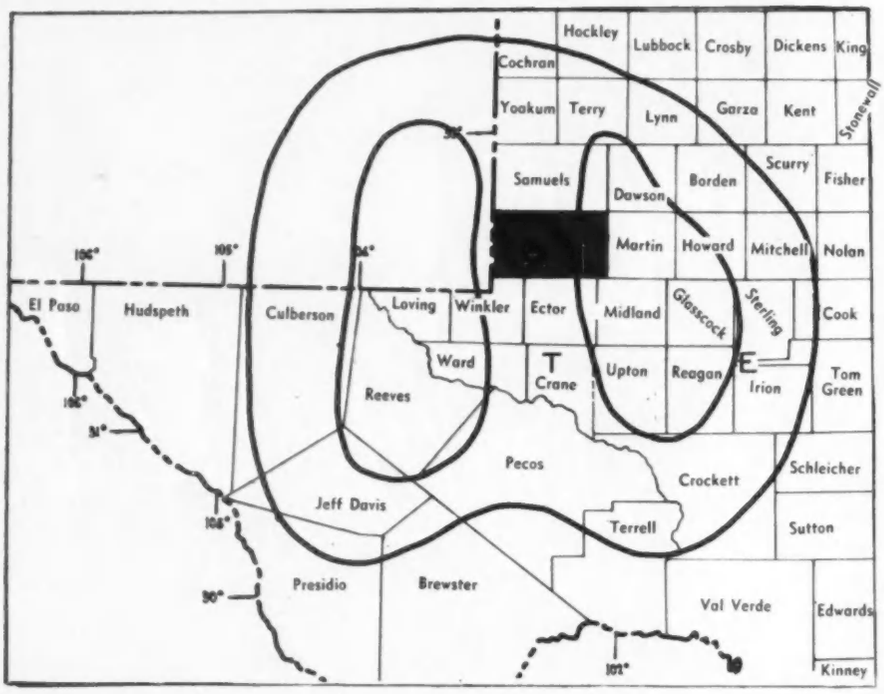


FIGURE 1. Dark area shows location of Midland Farms field, Andrews County, Texas, with respect to Delaware and Midland basins and Permian Basin area.

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Drastic Cuts in Corrosion Costs in Sour Crude Field

By FRANK H. CLEMENTS and JACK P. BARRETT
Stanolind Oil and Gas Company

CORROSION in the Midland Farms field of Andrews County of West Texas is being successfully attacked through the close cooperation between laboratory, engineering and production personnel. Use of chemical inhibitors to prevent hydrogen sulfide corrosion has proven successful both from an economic and chemical viewpoint. Cathodic protection on well casing to prevent microbiological corrosion is being tested. Although this phase of the program will not be known for sometime to come, indications are that it offers an economical way of combatting this type corrosion.

Hydrogen sulfide corrosion, electrolytic corrosion and corrosion due to action of sulfate reducing bacteria have been found present in the Midland Farms field, Andrews County, Texas. The effects of hydrogen sulfide corrosion were apparent at an early date as indicated by failure of both subsurface and surface equipment. It naturally followed that operating costs were excessively high because of necessary replacement of artificial lift equipment, frequent well pulling expenses and replacement of surface equipment especially susceptible to corrosion.

In order to reduce and possibly eliminate costs directly attributed to corrosion, it soon became apparent that it would be necessary to set up and place into operation an aggressive and well-planned corrosion mitigation program. The necessity of a corrosion control program was further supported by the fact that excessive corrosion costs made uneconomical operation of several wells in which corrosion was unduly severe.

The Midland Farms field is located in southeastern Andrews County in the extreme western portion of the Midland Basin (Figure 1). Production is from the Grayburg formation of the Upper Permian. Top of the producing section is at approximately 4600 feet and wells are bottomed at about 4900 feet. This interval is, however, not continuously productive in that zoning of the pay is present.

The casing program of the majority of wells completed to date consists of 8⅝-inch surface string cemented at about 200 feet and a 5½-inch oil string cemented at about 4600 feet.

This field was discovered late in 1944 and there are now approximately 270 completed wells in the field. Present development is on a 40-acre spacing pattern with an estimated 13,000 acres proven. All wells are on artificial lift by means of beam type pumping units. A considerable number of the wells produce large volumes of fluids which require use of tubing pumps (1¾-inch or 2¼-inch), and tapered sucker rod strings.

The produced gas and crude oil is very sour in that it contains a high concentration of hydrogen sulfide gas. All wells produce water in ratios ranging from as low as 2 percent to as high as 90 percent. The hydrogen sulfide content of the produced gas varies from about 4500-6000 grains per 100 cubic feet and, in some cases, is in excess of 6000 grains.

Treating Equipment Corrosion

Initially the wells produced little or no water. This resulted in moderate rod loading, and hydrogen sulfide corrosion of subsurface equipment was not an acute problem. However, corrosion in steel emulsion treaters was quite severe and treater life was from 24 to 48 months and required costly replacement. Use of a corrosion

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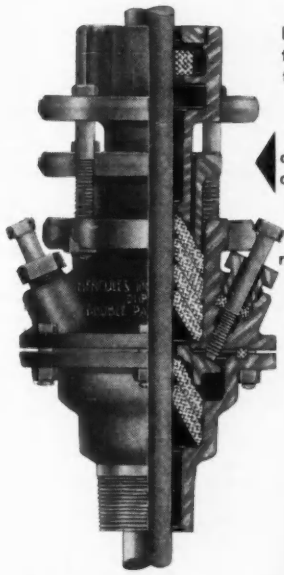

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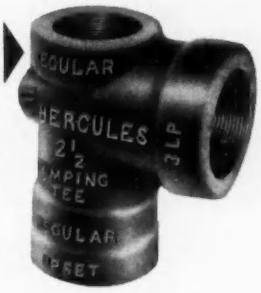

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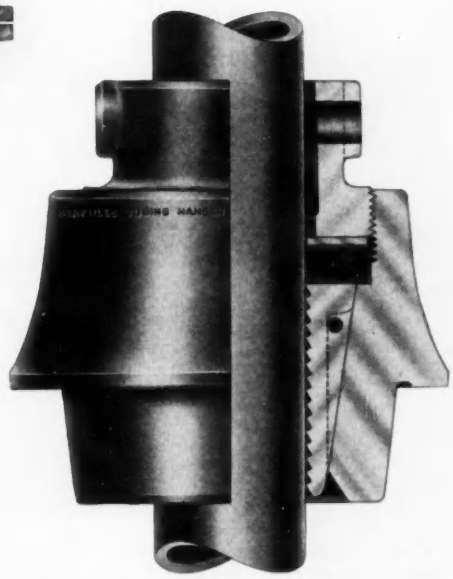
Hercules regular type tubing hanger.



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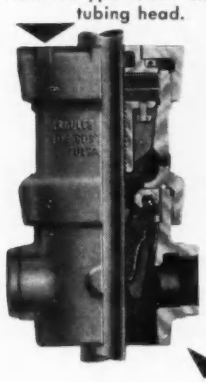
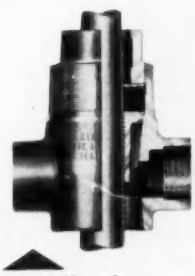
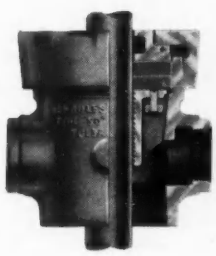
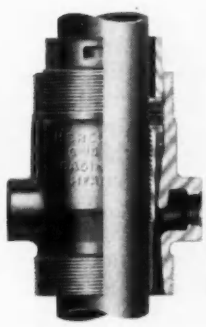


Hercules type "SO" tubing head.



Hercules type J-3 tubing head.





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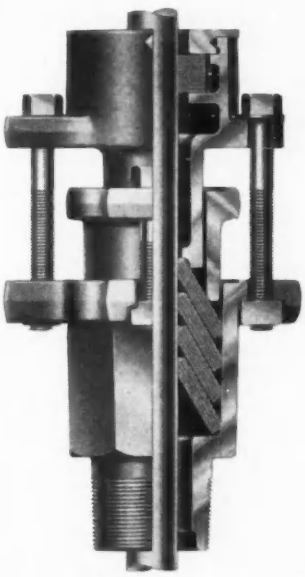

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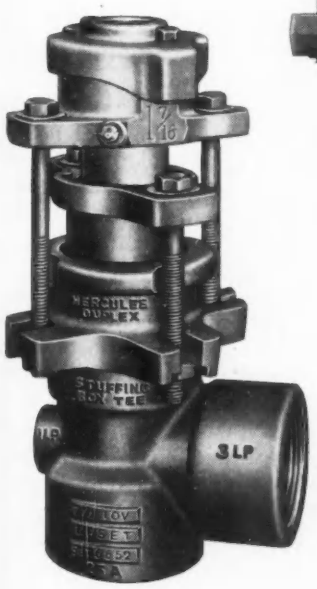

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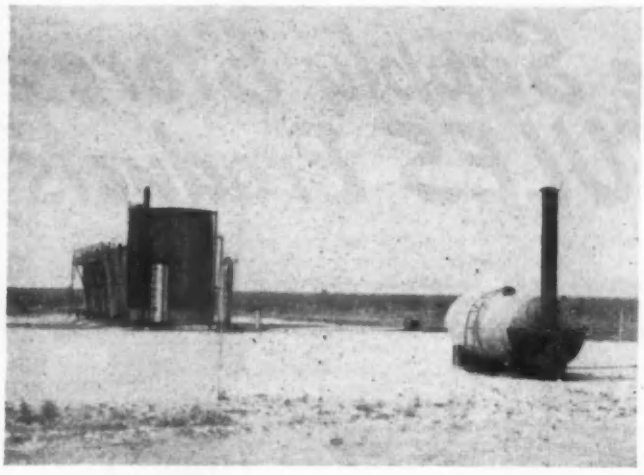


FIGURE 2. Lease treating equipment for sour crude production, Midland Farms field, Andrews County, Texas.

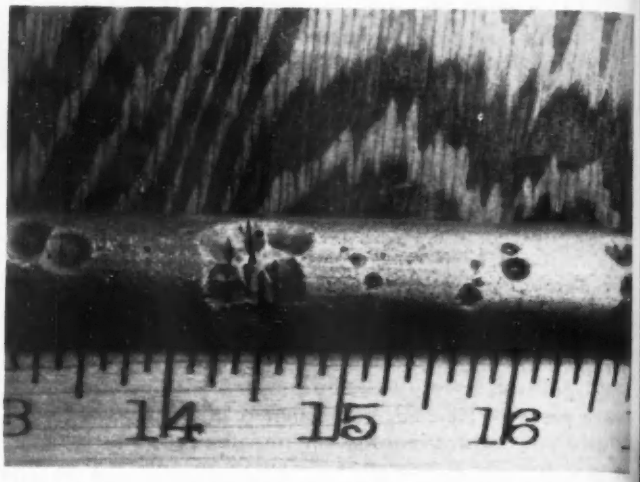


FIGURE 3. A section of sucker rod removed from a Midland Farms well after one month in service.

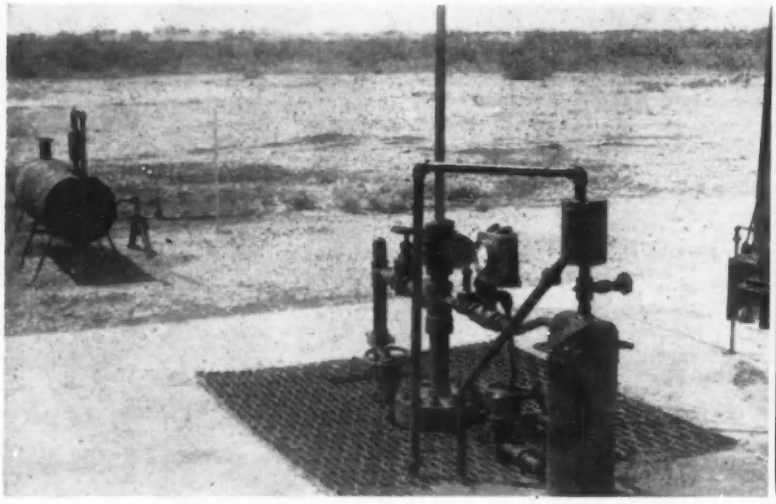


FIGURE 4. Closed system for injecting hydrogen sulfide corrosion inhibitor down casing annulus with storage drum, hand pump and time-operated shutoff valve to control amount of flush. Note insulating flange on flowline near storage drum.

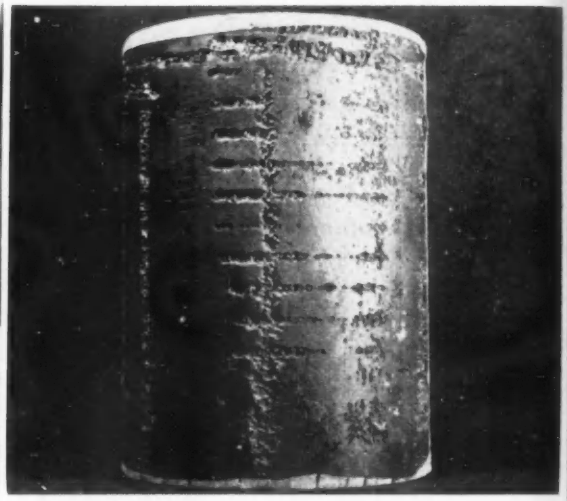


FIGURE 5. Section of casing removed from well after six years of exposure, showing typical corrosion attack.

inhibitor (formaldehyde) and cathodic protection for controlling treater corrosion was investigated. The use of these protective measures eventually proved successful and the life of a test treater was more than tripled. Although these methods of corrosion prevention gave every indication of success, the lack of immediate data on this problem as well as other operating problems, indicated to operating personnel at that time that the use of wooden gun barrels or settling tanks and indirect heaters with cast iron coils would be more satisfactory.

In using indirect heaters with cast iron flow tubes, scaling of the tubes resulted in another operating problem. The use of phosphate sequestering compounds has been very helpful but has not entirely solved this problem of scaling tubes. The general type of gun barrel indirect heater installation is shown in Figure 2.

A further step was the use of steam coil type wooden treaters, known as "redwood treaters." In this type of treating installation, steam is generated in a steam generator and heat transferred to fluids in the wooden gun barrels by means of cast iron or corrosion resistant coils. The installations now in use have not been in service a sufficient period of time to thoroughly evaluate them, but performance data available to date indicate that the scale formation and corrosion problems in treating equipment may be solved.

Corrosion of inside and outside siphons and water bleeder lines from gun barrels is being combatted by use of asbestos-cement pipe in several cases where it is especially severe.

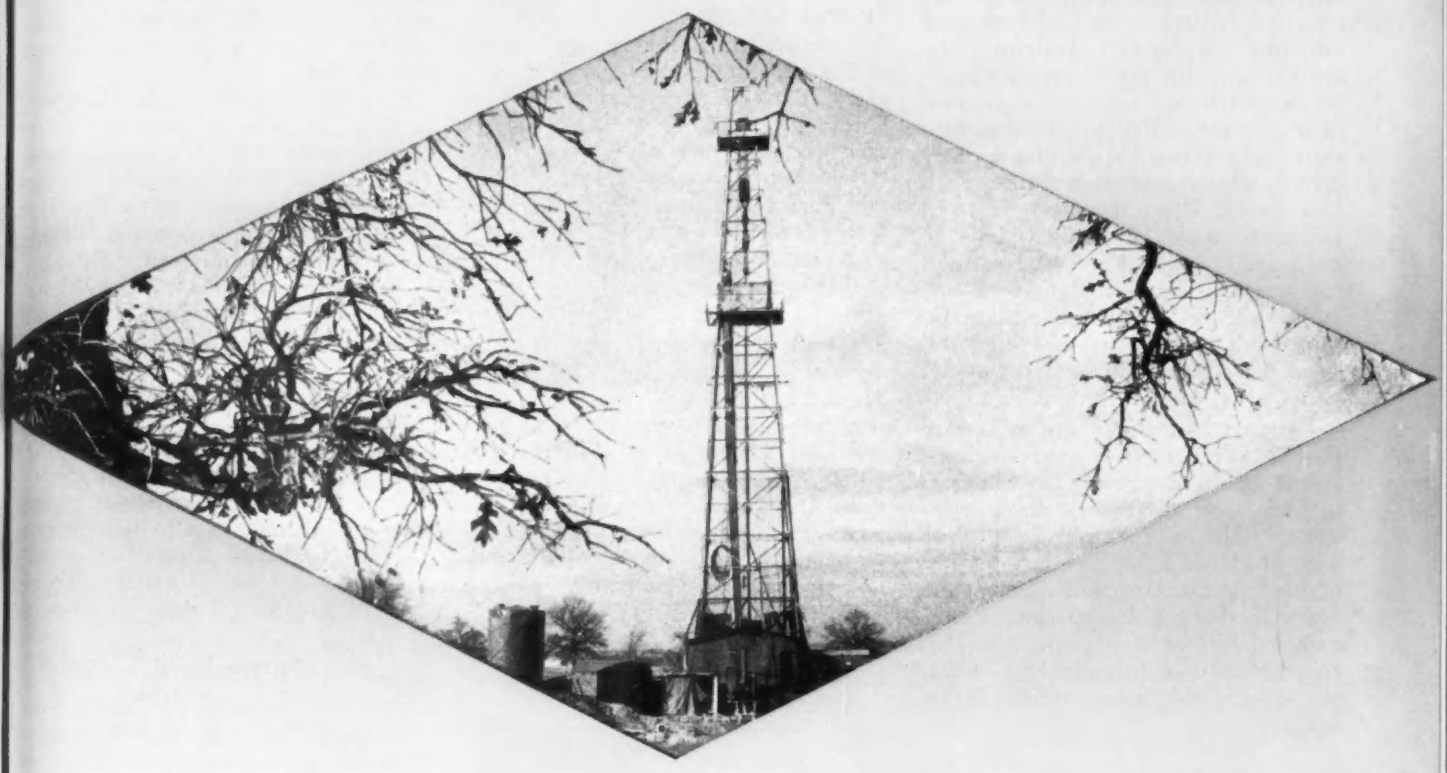
Sub-Surface Corrosion

Subsurface corrosion of well equipment was negligible in the early life of the field when wells produced little or no water. As water production increased corrosion became more severe and increased rod loads further aggravated the problem.

Hydrogen sulfide corrosion is clearly indicated by the presence of a black iron sulfide scale and by pitting on rods, tubing, and by failure of such rods by corrosion fatigue and/or hydrogen embrittlement. A typical rod is shown in Figure 3.

Large volumes of water produced imposed high sucker rod stresses which, coupled with the corrosion effects of the produced fluids, results in premature rod and equipment failure. Even incipient hydrogen sulfide corrosion can result in sucker rod failure if sucker rods are heavily loaded.

On the basis of extensive laboratory and field tests, it was determined that hydrogen sulfide corrosion could be



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controlled by the use of an inhibitor. In the course of conducting laboratory research and field test work, formaldehyde was found to be an effective hydrogen sulfide corrosion inhibitor[1] in air-free systems. The mechanism whereby formaldehyde inhibits corrosion is by the formation of a protective film on all subsurface equipment contacted by the formaldehyde or formaldehyde vapor. This film has a relatively short life and treatment must be applied daily to maintain the film. For best results, it is necessary that circulation of formaldehyde be established and maintained so that the produced fluids will show a positive formaldehyde test 24 hours after each injection.

Formaldehyde treatment is accomplished by daily injection down the casing annulus of 25 percent formaldehyde diluted with three parts water. This is followed by a flush with produced fluids to insure the formaldehyde reaching and mixing with fluids in the annulus space. Flushing of the inhibitor is important in that the build up of formaldehyde-sulfide polymers in the casing annulus is prevented.

Well Head Facilities

Well head facilities, consisting of a storage barrel and lubricator, for a typical installation are shown in Figure 4. A time-operated shutoff valve is being installed at each well so that the inhibitor can be flushed down the casing annulus with a minimum of labor. Flushing of any inhibitor down a well is necessary for best results and, unless automatically timed, could require additional time on the part of the pumper.

In addition to formaldehyde, a commercial liquid organic inhibitor is also being used and compares favorably with the former. This commercial inhibitor is of the oil soluble type, whereas formaldehyde is water soluble. In certain cases, such as in wells with high fluid levels, the water soluble formaldehyde is desired as it will fall through the oil layer and diffuse into the water column and circulate out the tubing. It has been found, however, that from an economic standpoint, it is, in some cases of high water-low oil production, better to use an oil soluble inhibitor. Formaldehyde also has the added advantage of being a volatile chemical and will, therefore, provide protection to the vapor space in the well annulus. At the present time, approximately 125 wells are on treatment with one or the other of the aforementioned inhibitors. All wells operated by the major operator in this field, or a total of about 215 wells, are to be placed on treatment and preference will be given to the use of formaldehyde. Cost of the formaldehyde delivered to the well is $0.32 per gallon. Average chemical cost of treating with formaldehyde is $0.16 per well per day.

About the Authors

FRANK CLEMENTS obtained his B.S. degree in petroleum engineering at Texas Technological College in 1942 and attended the University of Chicago for one year. After four years in the Air Force, he joined Stanolind Oil and Gas Company in 1946 as a roustabout in Pampa, Texas. After receiving roustabout-engineering training, he was transferred to the Andrews area and later to the West Texas District Office of Stanolind Oil and Gas Company in Midland, Texas. For the past two years, Clements has been field engineer of the Andrews area for Stanolind Oil and Gas Company.

JACK P. BARRETT, technical group leader of the corrosion section, Production Research Laboratory, Stanolind Oil and Gas Company, Tulsa, has been engaged actively in research and field application of corrosion control methods since he joined Stanolind in the fall of 1945. He holds a B.S. degree from William Jewell College, Liberty, Missouri, 1938. From 1938 to 1941 he was a chemist for the Kansas City, Missouri, Water Department, and from 1941 to 1945 he served as spectroscopist and chemist for North American Aviation, Inc.

Casing Corrosion

Gas present in the casing annulus of all wells is normally saturated with water at its pressure and temperature and, being high in hydrogen sulfide content, is of a very corrosive nature. Vapor space corrosion can be retarded by the use of a volatile inhibitor such as formaldehyde. In order to minimize external casing corrosion as the wells were hooked into the gathering systems, they were insulated from all lines by use of insulating flanges. Figure 4 shows such an installation.

Casing was pulled from four wells in 1951. Recovered casing from three of the wells showed external corrosion as illustrated in Figure 5. Corrosion was of a scattered random type of attack and, upon chemical analysis, iron sulfide and iron oxide scale were identified. The interval over which corrosion was present extended from about 200 feet to 1700 feet on one well and on the other down to depth of casing recovery of about 1400 feet. From the appearance of the corrosion, analysis of the corrosion products and absence of electrolytic effects, as determined by the running of casing potential surveys, it was concluded that external casing corrosion was caused by the action of sulfate reducing bacteria.

Survey Results

A survey of some of the information available (2 through 8) showed that the various strains of sulfate reducing bacteria are of the anaerobic type, can tolerate temperatures up to 194° F., salt (NaCl) concentration of at least 15 percent, and are active in an environment having a pH range of 5.5 to 8.5.

These bacteria are inactive in a media having pH values of 8.5 to 11; therefore, new wells were so drilled that a mud having a pH of 11 was left behind the casing at completion. This method of preventing this corrosion is practical in wells in which a high pH mud could be placed behind the casing at time of completion.

Further investigation into this type of corrosion and possible means of mitigation led to the conclusion that it should be possible to control it by cathodically protecting the casing of old completed wells. It is well known from cathodic protection work that an alkaline film will develop on the surface of buried steel when placed under cathodic protection. Further this alkaline buildup is an ampere-hour effect.

Field tests using a potential drop method of casing survey, disclosed that current densities of 0.04 up to 1.7 millamperes per square foot could be obtained on the casing by magnesium anodes buried at the surface and connected to the well head.

The rate of alkaline film (pH increase) on the steel cathode surface,

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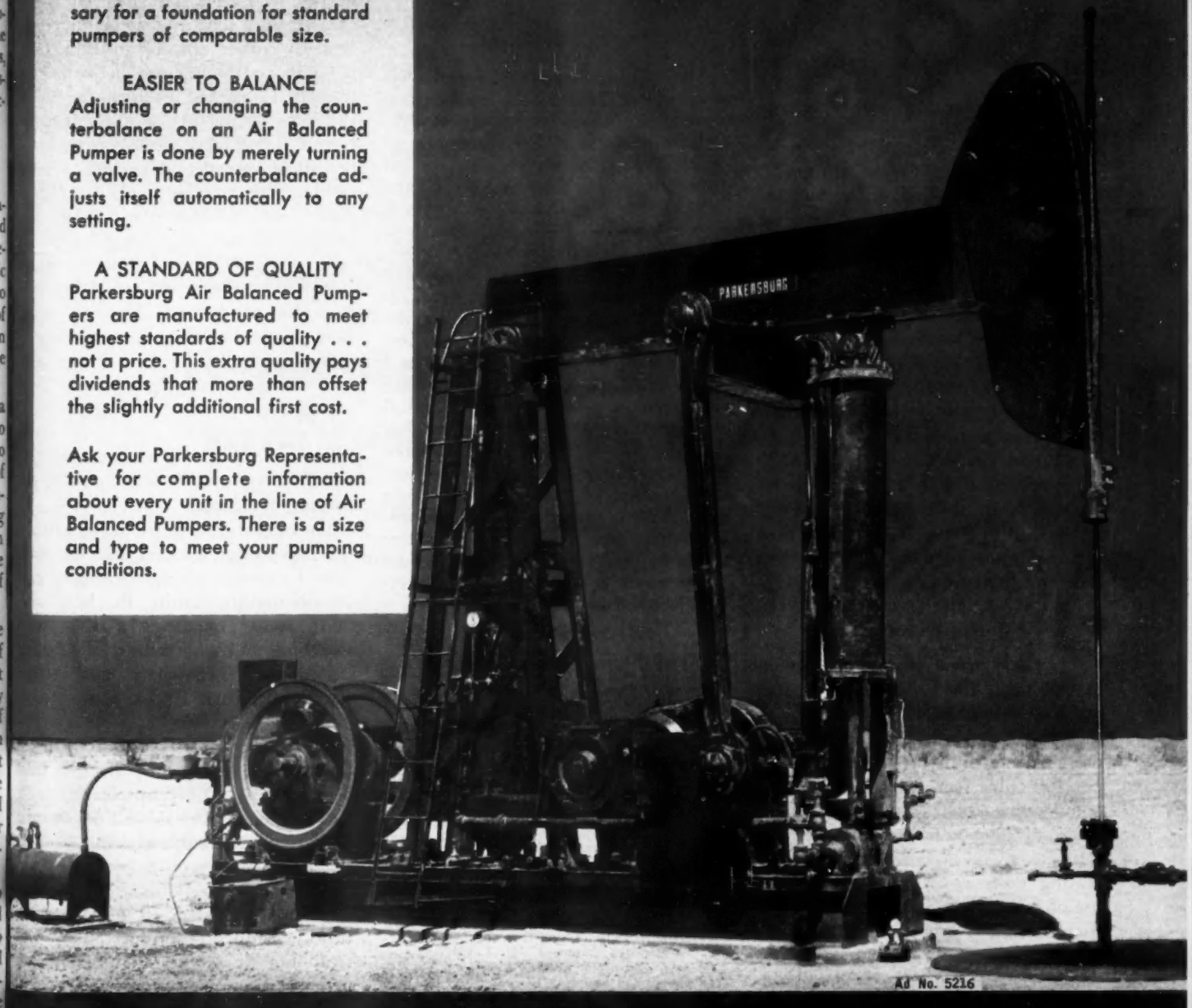

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at current densities of 0.03 millamperes per square foot was investigated by laboratory experiments. It was found that in media of the general chemical nature of the subject well bores a pH of 8.6 in nine days exposure could be obtained. It is logical to assume that as the reaction continues the pH will increase. This work is confirmed by related work conducted by LeFebvre and Sudrabin.[9] In their work it was concluded that cathodic protection when applied to submerged or buried steel, would raise the pH of a tubercle on the steel to nine.

This alkaline film at the pipe surface would react with the hydrogen sulfide, resulting from activity of sulfate reducing bacteria and also raise the pH of the material in the immediate vicinity of the cathode to a value of 8.5, or above, so that these bacteria would be rendered inactive. It was, therefore, considered feasible to protect the casing from this corrosion by cathodic protection, using surface anodes. Anode beds have been installed at about 211 wells, each bed consisting of six buried 17-pound magnesium anodes spaced 25 feet apart in two parallel rows with distance from wellhead to nearest anode being about 100 feet. Casing potential surveys run before and after installation of anode beds at several wells revealed that expected cathodic protection was being obtained. Anticipated life of these anode installations is estimated at from six to eight years. Total cost of installation was $125 per well. So that full benefits to be derived from these installations will be applied to the well casing, all flow line insulators are frequently checked to insure their proper functioning.

Engine Corrosion

For the first six years of operation in this field, the only source of fuel gas was the sour gas produced with the oil. As this gas contained 6000 or more grains of hydrogen sulfide gas per 100 cubic feet, it was not a desirable engine fuel. Multi-cylinder engines initially used were not entirely satisfactory because of excessive operating costs resulting directly from use of this sour fuel gas. As experience showed that a more economical and improved operation could be expected when using slower speed, single cylinder horizontal engines, this type of engine was used to replace multi-cylinder engines when replacement was necessary. Although single cylinder engines operated more satisfactorily and cheaper on sour fuel than multi-cylinder engines, costs were still considered unduly high. In the latter part of 1951, a supply of sweet gas was brought into this field for use as fuel gas, with the result that engine operating costs have been reduced and engine down-time virtually eliminated.

The use of sour fuel gas also resulted in a serious external corrosion problem on copper core engine radiators. Cause of this corrosion was attributed to hydrogen sulfide gas in the air, as well as sour exhaust gas from the engines. Tests made with various coatings showed that regular copper radiator cores dipped in a graphite paint have greatly reduced the corrosion and resulted in a longer service life of radiators.

Scaling Problems

Although scaling is not a corrosion problem, it results in considerable trouble and expense. Scaling of subsurface equipment has caused considerable expense for its removal. In some cases it was necessary to pull the rods, tubing, and pump about once a month to clean off scale. Produced waters are high in calcium and magnesium salts and result in deposition of carbonate and sulfate scales. This problem is being combatted by the use of various proprietory scale preventive compounds in both solid and liquid forms. In the case of subsurface equipment, a solution of the chemical is injected down the casing annulus, followed by a flush as considered necessary. For scale prevention in surface equipment, solid chemicals are used in bypass feeders with good results. In general, the scaling problem has been greatly alleviated by the use of the more common scale sequestering chemical compounds.

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[6] Hadley, R. F., "Microbiological Corrosion of Steel Pipe Lines," Oil and Gas Journal, Volume 38, No. 19, September 21, 1939.

[7] Huddleston, W. E., "Results Obtained from Five Years of Cathodic Protection of 24" Gas Line Rapidly Deteriorating from Bacterial Corrosion," *Corrosion*, Volume 3, No. 1, 1947.

[8] "How Engineers Solved Ventura's Leaking Well Case," Oil and Gas Journal, June 14, 1951.

[9] LeFebvre, F. J., and Sudrabin, L. P., "New England Water Works Association," Volume LXIV, No. 4, 309 (1950).

ACKNOWLEDGMENT

Appreciation is given to Stanolind Oil and Gas Company for permission to publish this paper.

Re-Completing Oil Wells

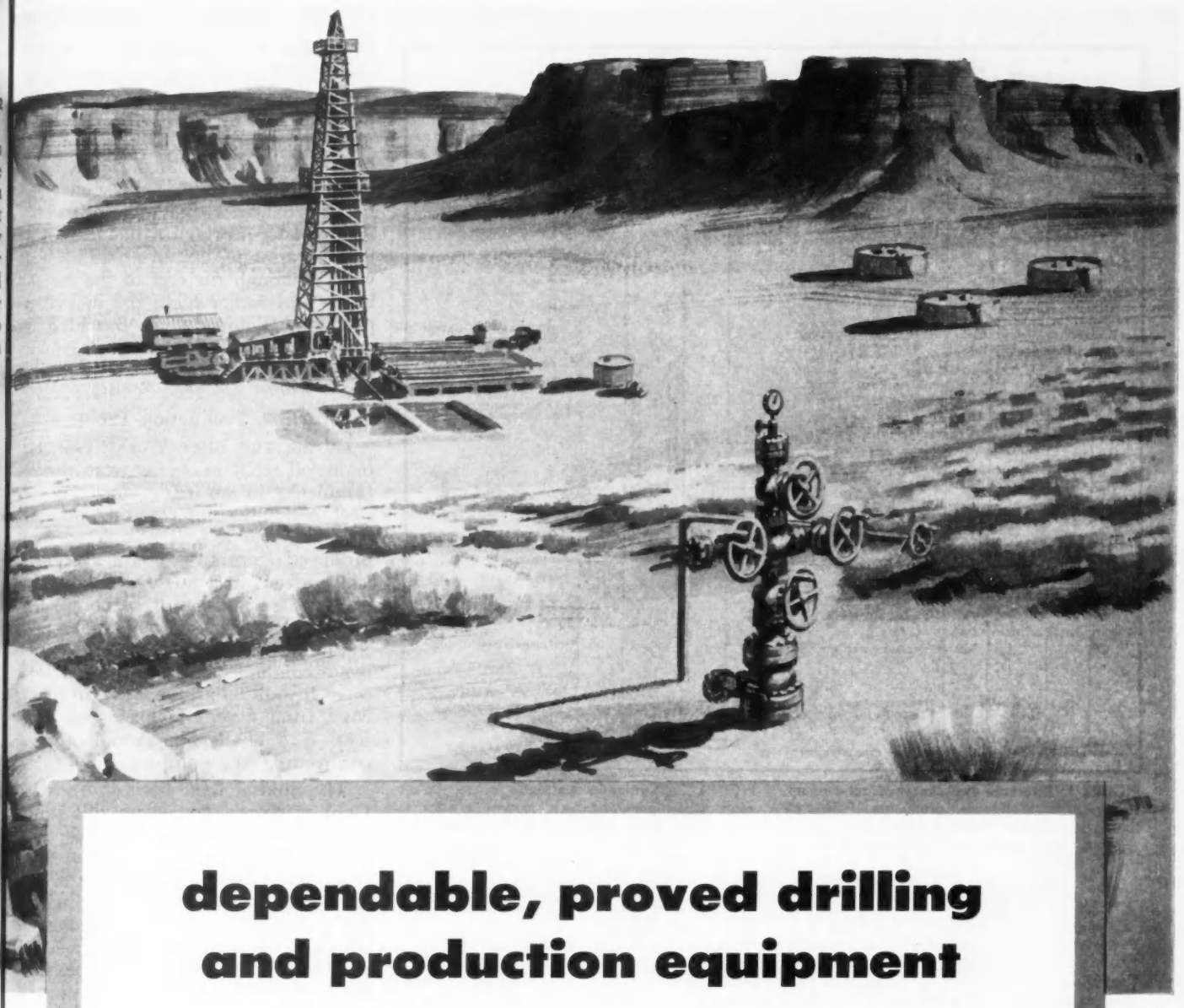
■ CONTINUED FROM PAGE 262

orifice well tester after each shot is fired, it is possible to estimate the relative production ability of each zone. By carefully recording the exact points where increases in gas flow were noted, the selection of zones for additional perforations is made and the desired completion pattern for every interval can be determined to attain a maximum flow in a minimum of cost and time.

Shot Density Increased

In order to overcome either natural or man-made barriers now existing in the well, the shot density is increased with four additional shots per foot. By correct spacing in the known portions containing gas, as evaluated from the original perforations with the gun perforator, a minimum of time is consumed and the shots are placed in known portions that should produce commercially. The results indicate that at this point maximum production can be gauged with the orifice well tester during the completion of perforating the remaining sections for production. Upon completion of perforating operations, the well is controlled by the blowout preventer containing blank rams. This provides a means of killing the well with either water or mud so that tubing can be run and a christmas tree installed for production through the casing or tubing.

The operator has then accomplished the completion process. He has estimated reservoir yield, minimizing cost by eliminating loading the hole with fluid, round tripping tubing, and swabbing to test a zone that possibly would not be productive prior to testing another zone. He has spaced shots affording maximum penetration throughout the zones in their entirety, affording a fair test with the least possible cost. For example: 60 holes with a gun perforator will test a total of 60 feet, negligible rigtime, and no swabbing. On the other hand, 60 holes using a shot density of four per foot would have tested 15 feet plus rig time consumed, running tubing, and swabbing in a zone that might not produce. The net results of increased shot density placed properly has resulted in minimum shots and rig time, reducing service cost, and maximum production insuring added income.



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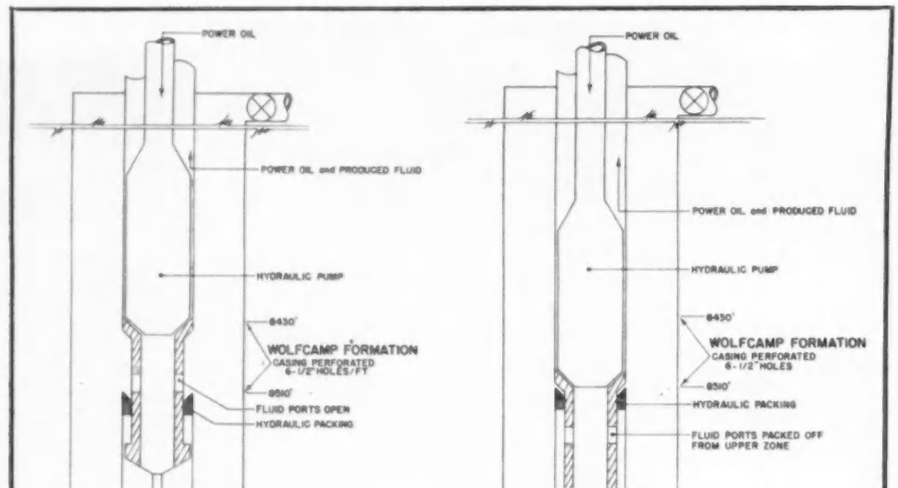


FIGURE 1. Alternate two-zone hydraulic pump. Upper zone, Wolfcamp, producing. Power oil tubing is raised by two hydraulic jacks on well head when producing from upper zone.

FIGURE 2. Two-zone hydraulic pump, Lower zone, Devonian, producing. Hydraulic jack is bled off to lower power oil tubing to produce from lower zone.

Production problems overcome by unique surface and subsurface hookup. Quick payout is provided and output increased at Shafter Lake where Gulf Oil Corporation is . . .

Hydraulically Pumping Dual Completions

By THERON E. HORTON
Gulf Oil Corporation

HYDRAULICALLY PUMPING dual completions by raising and lowering the power oil tubing is new in West Texas, and successful operation of three such wells in the Shafter Lake field of Andrews County has made increases in production possible. Not new to the industry, this type of installation has been employed with success in Oklahoma. The Shafter Lake installations were on an experimental basis from July, 1951 to July 1952, and have produced satisfactorily. The Railroad Commission of Texas has extended the operating period for an additional year. Monthly allowables for each zone has been produced without difficulty, and production has been kept separately in accordance with regulations. The Railroad Commission has extended the operating period for an additional year. Although the cost of the installation was rather high, the increased production gained has provided a rapid payout of the installed equipment.

Wartime Production Problem

During and after World War II, many oil wells in Texas were dually completed in an effort to conserve steel. A dually completed oil well may be defined as a well completed and produced from two separate geological horizons in a single well bore. In Texas these wells must be completed and produced in such a manner that the fluid from the two separate zones is not comingled. Efficient production of such wells by artificial lift, in many cases from depths in excess of 7000 feet, is a challenging problem now confronting the industry.

The Shafter Lake field of Andrews County is one area where this problem exists. In this field, the Wolfcamp pay, at an approximate depth of 8500 feet, is dually completed with the Devonian pay which is approximately 9700 feet in depth. The Wolfcamp reservoir has a solution gas drive and produces from porous limestone. Original gas in solution was approximately 670 cubic feet per barrel and the original bottom hole pressure was 3468 pounds per square inch at minus 5225 feet. The average bottom hole pressure in June, 1950, was 1744 psi at minus 5225 feet. The Devonian reservoir has a solution gas drive and produces from porous dolomite.

Original gas in solution was approximately 385 cubic feet per barrel and the original bottom hole pressure was 4085 psi at minus 6500 feet. Average bottom hole pressure in August, 1951, was 2402 psi at minus 6500 feet. As the result of the rapid decline in bottom hole pressure, many of these wells have ceased to flow naturally from one or both pays and require artificial lift equipment.

Among the methods available to the industry to artificially lift a dually completed well are gas lift, rod pumping and hydraulic pumping. In the Shafter Lake area, high-pressure gas to gas lift wells at this depth is not readily available. With rod pumping the rod load would be great, but

would not preclude satisfactory operations. Producing depths and volume requirements of the lift indicated that the hydraulic pump would be the most desirable installation. A hydraulic pumping installation with 2½-inch tubing would make possible the production of as much as 350 barrels of fluid per day, while a conventional rod pump operating at these depths could not produce this volume.

Either the rod pumping or hydraulic pumping installation using a two-zone control valve requires that the operator produce each zone alternately. Higher volumes would be required to obtain the well's allowable than would be necessary if it were possible to produce each well every day, and the monthly allowable would have to be produced in one-half of the month. Thus, the higher rate of production of the hydraulic pump would be utilized to the fullest extent.

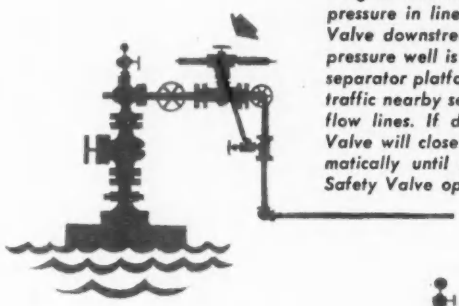
The Devonian pay in this field has a partial water drive and water is being returned to the flanks of the field. It is probable that at some future date the operators may be required to lift increasing amounts of water, and this in turn is another reason for choosing the higher volume hydraulic pump.

Experimental Installation

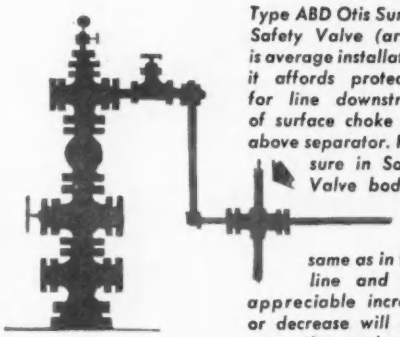
Gulf Oil Corporation received permission in June, 1951, from the Railroad Commission of Texas to equip and produce their dually completed wells in the Shafter Lake field with a hydraulic pump utilizing a two-zone control valve for a one-year experimental period. In addition, exceptions to the 10 percent tolerance production rule were granted in order that allowables might be produced from both zones of each well during the calendar month.

On August 15, 1951, an installation of this type was completed and put in operation on Gulf Oil Corporation's Texas "QQ" 2-Wo-D. The installation is a simple one, and sub-surface equipment is shown in Figure 1 and 2. A production packer is set between the two pay zones, thus isolating one from the other when the installation is complete. The two-zone control valve is set in the tubing string immediately above the packer, and the rest of the installation is practically the same as any conventional hydraulic pumping installation.

A 2½-inch hydraulic pump is used to which power oil is furnished by one-inch power oil tubing suspended inside 2½-inch production tubing.

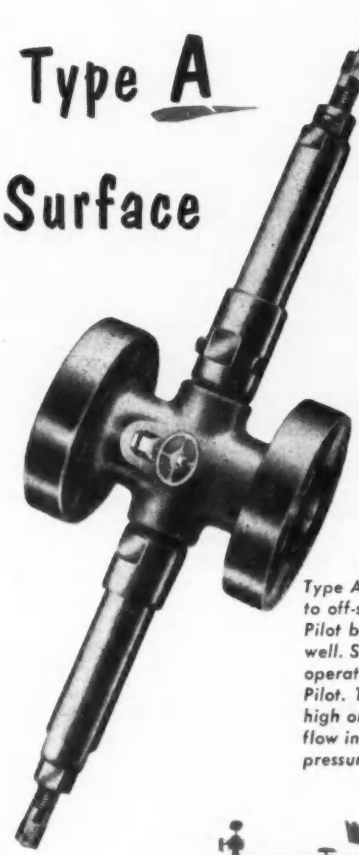


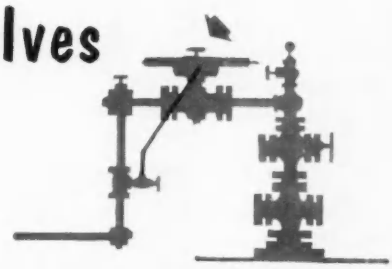
Type AAM1 Otis Surface Safety Valve on flow wing of offshore well (arrow) is controlled by pressure in line (red) from Type M Otis Check Valve downstream of surface choke. This high-pressure well is one of many flowing to central separator platform, also offshore. Heavy marine traffic nearby seriously endangers the trees and flow lines. If damage occurs, the Otis Safety Valve will close in the well instantly and automatically until repairs can be made and the Safety Valve opened manually and reset.



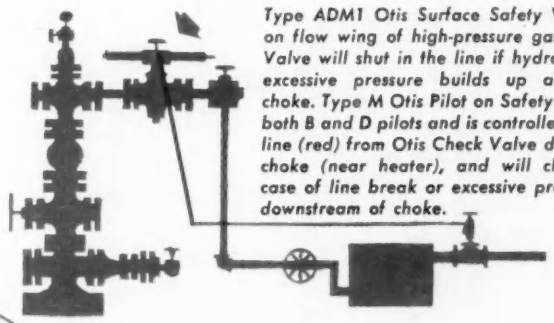
Type ABD Otis Surface Safety Valve (arrow) is average installation; it affords protection for line downstream of surface choke and above separator. Pressure in Safety Valve body is same as in flow line and any appreciable increase or decrease will activate pilots and cause safety device to shut in line automatically. No external connections are required on installations like this one.

Otis Type A Surface Safety Valves





Type AAH1 Otis Surface Safety Valve installation (arrow) similar to off-shore well described above uses Type H Otis Safety Valve Pilot because flow line pressure is only a fraction of pressure in well. Source of pressure to activate Safety Valve pilots is through operating line (red) from Type M Otis Check Valve to Type H Pilot. This well is protected from pressure variations either too high or too low from present limits. Check Valve prevents further flow into M Pilot after valve is closed, will also close if the outside pressure line is broken.



Type ADM1 Otis Surface Safety Valve (arrow) on flow wing of high-pressure gas well. Safety Valve will shut in the line if hydrates form and excessive pressure builds up above surface choke. Type M Otis Pilot on Safety Valve carries both B and D pilots and is controlled by pressure line (red) from Otis Check Valve downstream of choke (near heater), and will close valve in case of line break or excessive pressure in line downstream of choke.

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The two-zone control valve controls the zone from which the well is being produced. By raising or lowering the tubing a distance of approximately 18 inches by means of hydraulic jacks at the surface, production is obtained from either the upper or lower zone as desired. When the valve is in the upper position (Figure 1), the lower zone, or Devonian, is blanked off and the ports to the upper zone, or Wolfcamp, are exposed. When the valve is in the lower position (Figure 2), the Wolfcamp is blanked off and the ports are open to the Devonian pay.

A surface tubing lift has been designed to make it easy to raise and lower the tubing and consequently change the position of the two-zone control valve. Production tubing with power oil tubing inside is supported on a yoke by two hydraulic jacks which are raised by the power oil fluid used to operate the hydraulic pump, power oil tubing is lowered by allowing the fluid to be bled off. Conventional slips retain the tubing in place for any desired setting. Surface power oil and production lines are made flexible by the use of swing joints to eliminate the necessity of making and breaking the fittings each time the tubing is raised or lowered.

How Problems Solved

As in the case of any new installation, it was necessary to work out certain mechanical and operating problems before the installation operated properly. For instance, some trouble was experienced with plugging of the ports in the two-zone control valve when the first installation was made. This difficulty was eliminated by circulating crude oil through the ports and no further trouble has been experienced. Normal difficulties with surface facilities and sub-surface pump failures have occurred. However, these difficulties have been overcome and the well has produced its scheduled monthly allowable from each pay without serious shutdowns while meeting all requirements as set forth by the Railroad Commission.

The operator and the Railroad Commission both wish to keep these reservoirs separate during production operations. There are several ways of determining that this separation is being maintained: there is a difference in the gravity of the crude oil produced from each zone; there is a difference in hydrogen sulfide content; there is a slight difference in color; and, there is a considerable difference in the operating pressure of the pump on lifting each zone. Use of these characteristics enables the operator to determine rather definitely whether one zone is completely isolated from the other during production operations.

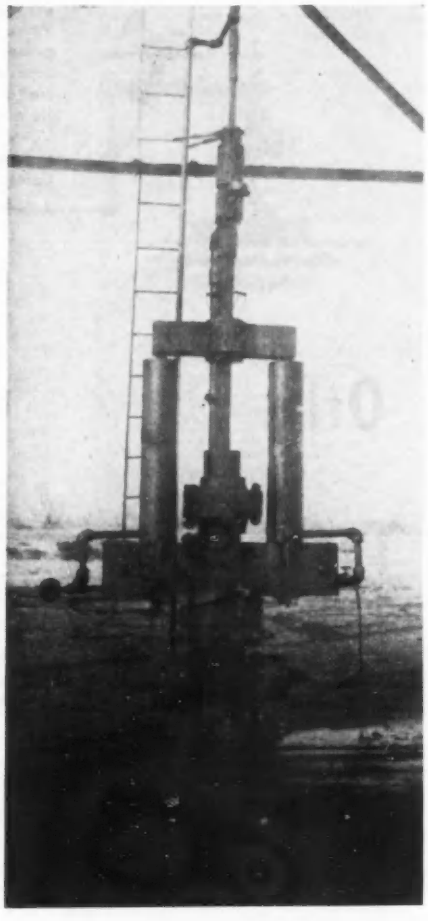


FIGURE 3. Surface equipment on dually-completed well. Two hydraulic jacks on each side of tubing, raise and lower a two-zone control valve down hole.

TABLE 1

Gulf Oil Corporation Monthly Oil Production
Texas "QQ" 1-, 2-, 3-Wo-D

DATE	Wolfcamp Zone Monthly Prod.	Devonian Zone Monthly Prod.	Remarks
1951			
January	0	8728	
February	0	8252	
March	0	9429	
April	0	9291	
May	528	9861	
June	738	7226	
July	0	9746	
August	526	6152	Two-Zone Control Valve and Pump Installation (8-15-51), Texas "QQ" 2-Wo-D
September	139	9312	
October	3088	8681	
November	3075	5153	
December	3092	4249	
1952			
January	2942	5949	Two-Zone Control Valve and Pump Installation (1-15-52), Texas "QQ" 3-Wo-D
February	5240	6298	
March	5312	3542	Two-Zone Control Valve and Pump Installation (3-16-52), Texas "QQ" 1-Wo-D
April	6500	6828	
May	3557	2537	One Zone in Each Well Not Produced, Pipe Line Proration
June	7032	8168	
July	7234	7276	

Other Wells

Two other wells, Texas "QQ" 1-Wo-D and 3-Wo-D, have been equipped with hydraulic pumps, one utilizing a two-zone control valve as previously described, and the other utilizing slightly different down-hole equipment but which accomplishes the same purpose. Two additional wells, Texas "PP" 3-Wo-D and 4-Wo-D, are being considered for this type of installation.

On the Texas "QQ" lease, surface facilities are maintained to produce and store the oil in the prescribed manner. Separate storage tanks, power oil tanks, treating systems with gunbarrels, gas separators and power oil pumps have been provided for the production from each pay.

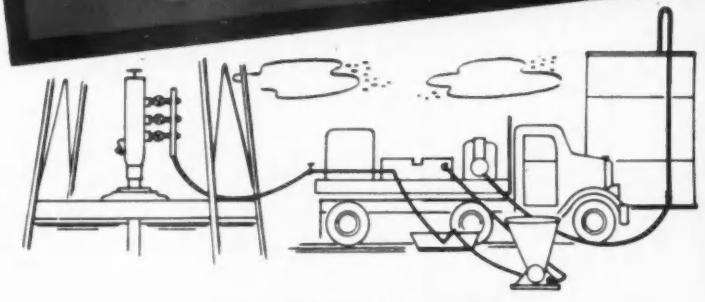
Production Record

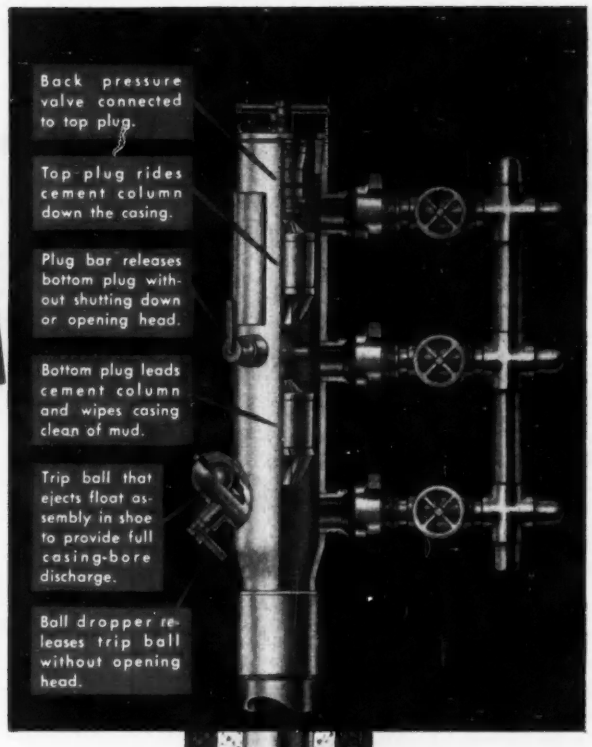
Production of oil (Table I) from Texas "QQ" 1-, 2-, and 3-Wo-D during July, 1952, represents an increase of 49 percent over the month of July, 1951, the last month prior to the hydraulic pumping installation in Texas "QQ" 2-Wo-D. Since production for July, 1951, was based on 24 producing days, and production for July, 1952, was based on 18 producing days, the percentage increase does not present a true comparison. On the basis of 24 producing days for July, 1952, a 97.5 percent increase over July, 1951, would have been realized. However, neither of these percentages means a great deal as production from these wells in July, 1952, would have been negligible without lift equipment.

About the Author

THERON E. HORTON, equipment engineer for the Fort Worth Production Division of Gulf Oil Corporation, was graduated from Texas A. & M. College in 1949 with a B.S. degree in petroleum engineering. Following graduation, he joined the Gulf Oil Corporation as an engineering trainee in the North Ward-Estes field in West Texas. In 1951, he was transferred to Goldsmith as petroleum engineer, and in the early part of 1952 was assigned the job he now holds.

From HEAD to SHOE




Back pressure valve connected to top plug.
Top plug rides cement column down the casing.
Plug bar releases bottom plug without shutting down or opening head.
Bottom plug leads cement column and wipes casing clean of mud.
Trip ball that ejects float assembly in shoe to provide full casing-bore discharge.
Ball dropper releases trip ball without opening head.

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Float assembly is pressure-ejected from the float shoe by the trip ball after casing string has been floated to position. This unrestricted opening reduces the load on the pumps . . . circulates greater volume with same pump pressure and results in higher velocity in space between casing and bottom of hole.

POSITIVE FLOW-BACK

When the back pressure valve, which has traveled down with the top plug, latches in the stall collar, it positively prevents flow-back of cement. Operator may bleed the pressure back to zero and leave the well open or close it in at final runnjng pressure.

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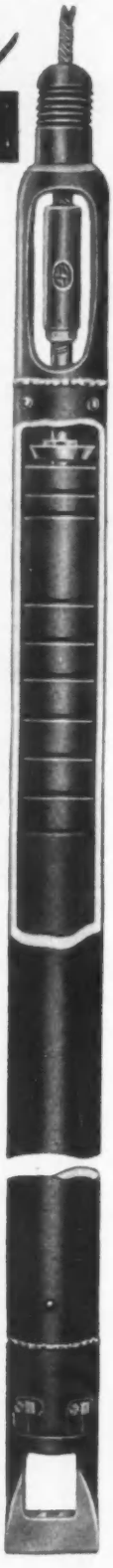

Chisel Bottom Illustrated

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Jetting Sump Used as Transfer Pump

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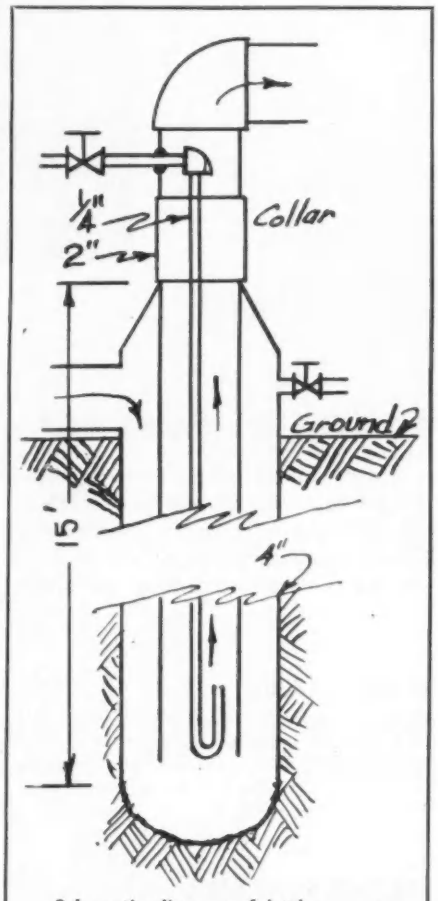


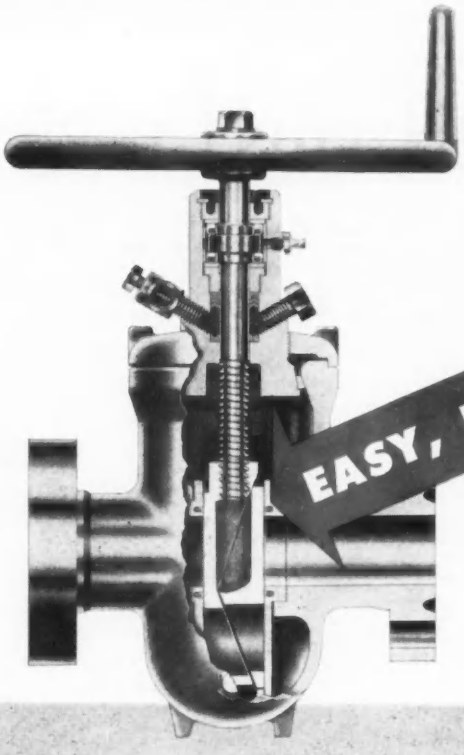
Schematic diagram of jetting sump.

THE principle of jetting mud and shale has been applied to production practices where it is used in place of a transfer pump around a tank battery. Although the jetting idea is an old one, several innovations make this a practical adaptation.

This jet proved capable when no pump power was available to transfer oil from one tank to another, run the bottom oil through the heater-treater or lift water from inside the fire wall, as well as other jobs. A sump was formed by burying a 15-foot section of four-inch casing closed at the bottom. The hole was dug with an ordinary posthole digger. The top of the four-inch casing was beveled closed around a section of open-ended two-inch inserted down the center of the four-inch as shown. A gas jet line of ¼-inch pipe extended inside the two-inch line and was reversed at the bottom so the discharge end pointed upward. The gas jet line was welded through the wall of a short two-inch nipple and equipped with a needle valve.

The discharge from the two-inch was equipped with gate valves so the flow of liquids and gas could be directed where desired. A two-inch line was welded to the four-inch casing above ground level. It was through this line that the liquid to be transferred flowed into the four-inch sump. Liquid would gravitate into the sump, and with about 100 pounds per square inch gas pressure from the separator, contents of the sump could be moved very quickly by the jet action. This device was excellent for rolling tank bottoms and for moving the emulsified oil back to the heater-treaters for retreatment. Since there are no moving parts, there is no maintenance, and the expense involved was relatively small.

Surface equipment of jetting sump.



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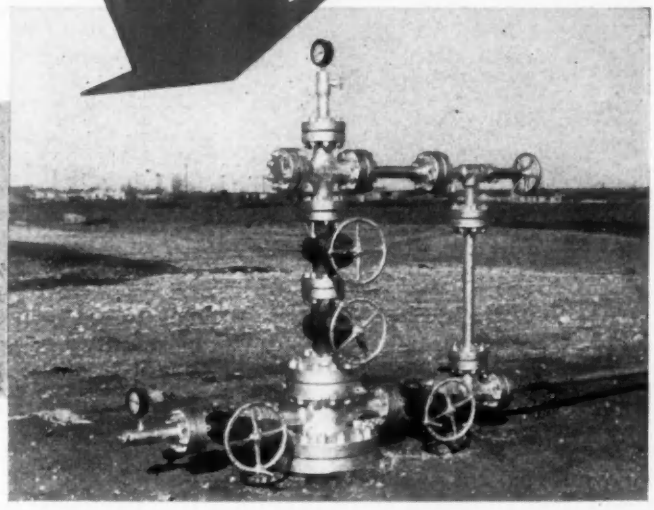

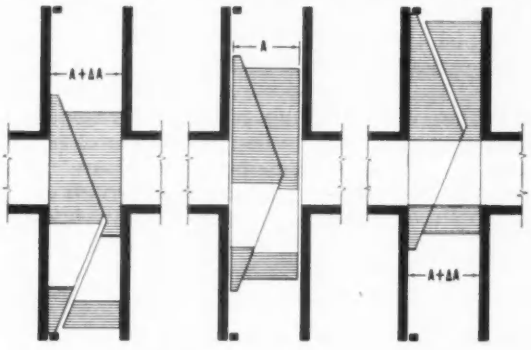

In closed position, the gate (left) and segment (right) seal tightly against both seats.

When opening or closing, the gate and segment are in neutral position, permitting free upward or downward movement of the gate assembly.

When open, the gate and segment again seal tightly against both seats and the bore of each lines up perfectly to provide a smooth, turbulence-free passage.

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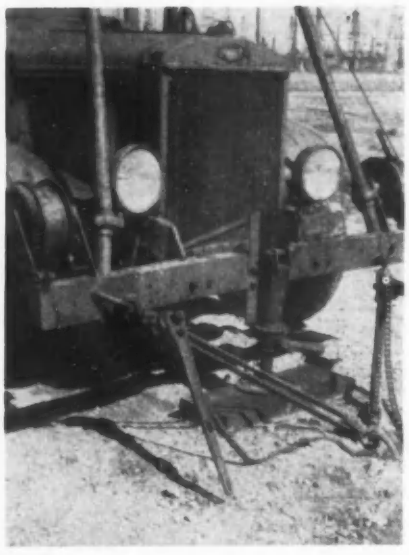


Winches Anchor Pulling Unit

Anchoring the front end of a pulling unit, the front bumper of which serves as the anchor for two back guys, may be done efficiently and with a minimum of time and effort.

In the installation shown, the front bumper, a length of heavy channel iron, has a hand-operated, powerful winch at each end. These winches serve both as anchors and as storage reels for the guys when the mast is down. In the center of the bumper is a shop-made angle iron bracket. On it is a screw jack with which the load is taken off the front wheels of the pulling unit. This jack bracket is designed in such a way that the jack need not be removed between jobs. The unit is simply swung upward through 180 degrees and locked in position by running a pin through matching holes in the two angle iron sections. Sucker rod loops welded to each end of the bumper provide a means of attaching ratchet-type come-alongs that are, in turn, anchored to a single deadman two feet out in front and on the center line of the pulling unit.

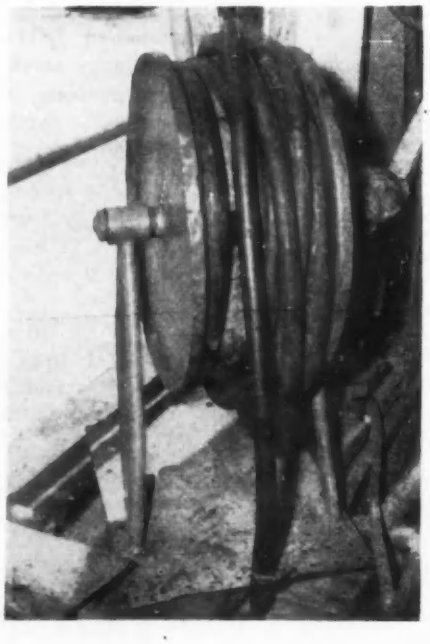
With this arrangement, only a few minutes of crew time are required to install the back guys, anchor the unit and disassemble them when the unit is moved to the next location.

Rotating Drum Stores Hose

A small, shop-made drum provides storage for the washdown hose on small well maintenance rigs. Not only does this device make it more convenient to handle the hose, but its use insures long life of the hose, and eliminates a tripping hazard on the floor area.

Diameter of the drum is approximately 24 inches and it measures about 18 inches wide. Each flange of the drum is welded to a piece of 1¼-inch pipe that serves as an axle for the drum and as a supply line for the water. This axle rests on two collar bearings, suported on either side of the drum by two A-frames welded to a sheet metal base. A steel swivel is conected to one end of the axle while the other end is plugged. This steel swivel was connected to the water supply system and enables the drum to be rotated while water flows into the washdown hose.

A small collar is welded to the axle member so that the hose could be connected to it. In this manner, the rubber hose can be spooled on the drum and when needed can be quickly unreeled without bothering about making connections.



This Pipe Rack Is Easily Moved

Several features incorporated in this pipe rack for warehouse storage make it particularly adaptable for all field uses in addition to permitting easy disassembly and moving. Essentially, it is not unlike most conventional pipe racks found around any field warehouse or storage yard. It consists of non-welded horizontal runners on which the stored pipe rests. These runners are made of salvaged drill pipe and will support a considerable load. The upset ends have been cut off so that they butt up against each other and rest in pipe saddles mounted on top of vertical supporting legs.

Footing for each leg is provided by a double-barreled section of casing or drill pipe, each piece of pipe welded to the other. Just below the saddle on each leg is a five-inch collar that has been welded to the saddle and to the vertical leg member. Purpose of this collar is to carry a 30-foot joint of drill pipe that provides lateral support to prevent the rack from falling over.

Such design and construction make the rack completely portable in that it is easily dismantled piece by piece and transported to a new location. The horizontal runners are not secured, but merely rest in the saddle supports. Each vertical leg is separate and can be loaded by two men.

FOR USE IN:

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165 horsepower 6 JVG packaged compressor plant. Other sizes from 110 to 550 horsepower.

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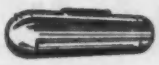
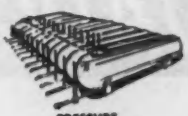


ANHYDROUS AMMONIA EQUIPMENT



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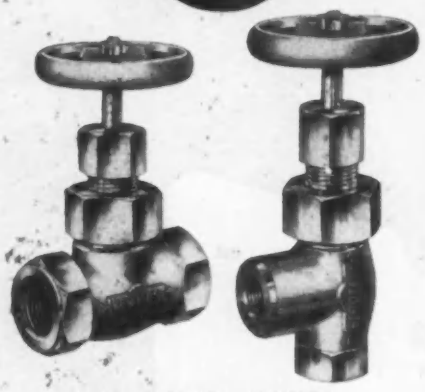

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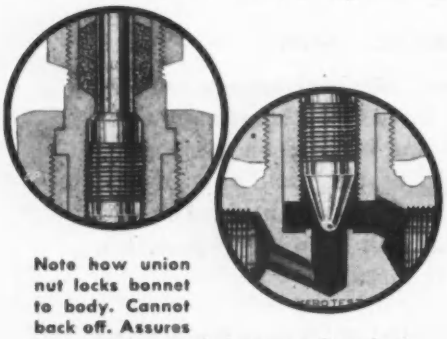

Note how union nut locks bonnet to body. Cannot back off. Assures safe repacking under pressure. Stem back seats for safety. Conical stem tip provides micrometer throttling action and positive seal.

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Mounted Equipment Is Economical

Mounting auxiliary equipment for small well maintenance rigs has proven economical in moving and setting up. One trailer load and one loading operation is all that is necessary to move the complete assembly shown here.

A long skid made of salvaged pipe serves as a foundation for a portable generator unit, water pump and motor, tool box and work bench. The four-wheeled engine-driven electric generator furnishes all power for the rig, including lights, electric controls, motors and communications. It is a conventional mobile unit bolted to a specially-designed base. To make the equipment available for other work where needed, nothing was changed in the framework design. Two horizontal runners, slightly longer than the distance from axle to rear axle, were elevated above the skid runner level by vertical supporting posts. These posts were welded to cross members connected between skid runners. The unit is positioned on the skid by placing a timber ramp under the wheels and backing the unit by truck onto the unitized skid. The axles are secured to the skid by U-bolts clamped around the elevated horizontal members.

A centrifugal pump and driving electric motor were mounted on a separate small skid containing a control box. This small skid was placed across the larger skid and bolted in place as shown. The pump, powered by electricity supplied by the electric generator, furnishes wash down water and water for mud and other purposes

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TANDEM OR SINGLE AXLE SEMI-FLOATS
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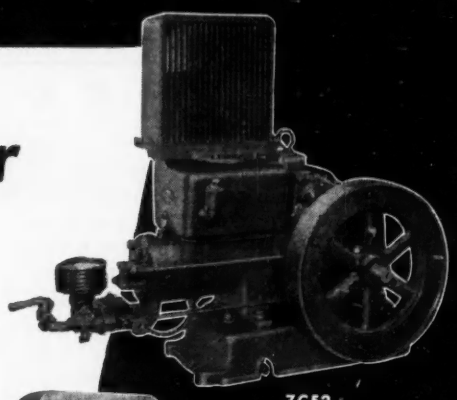

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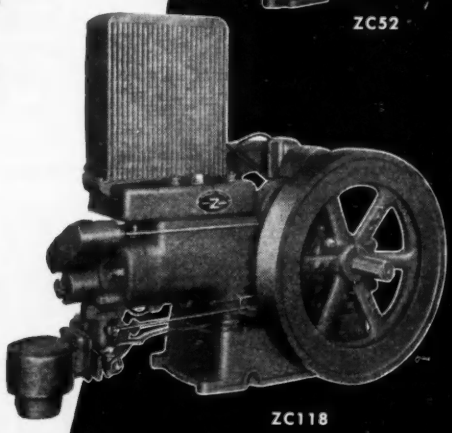

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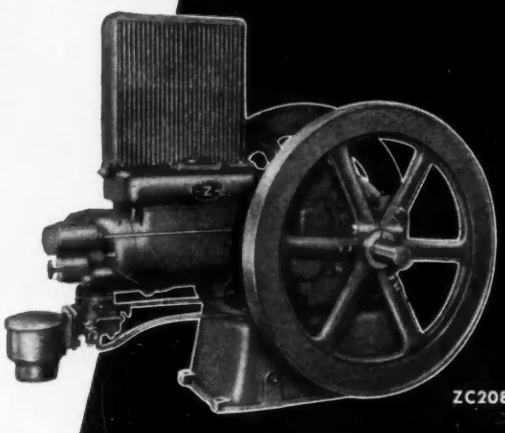

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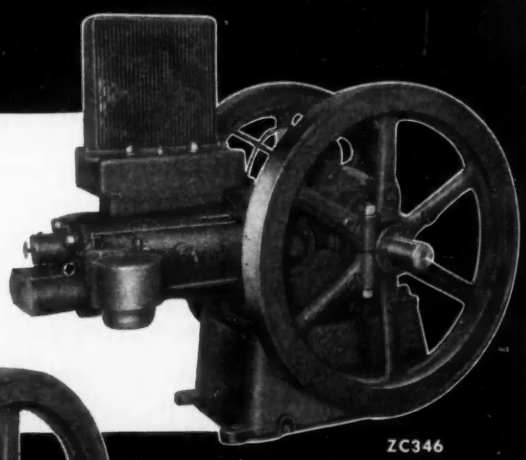

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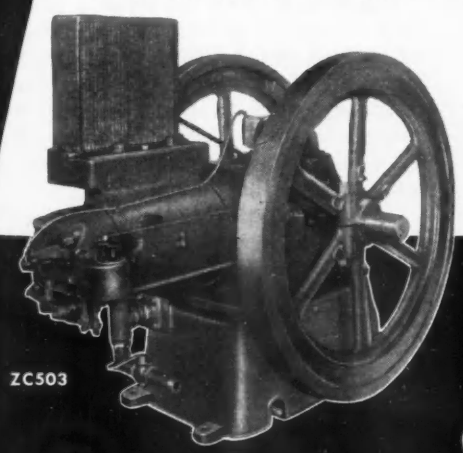
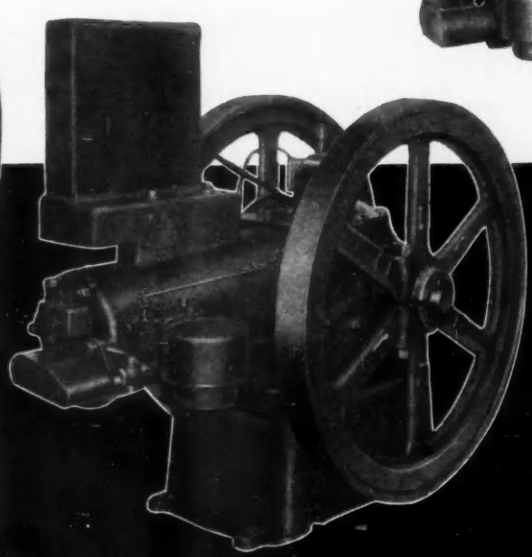


ZC503



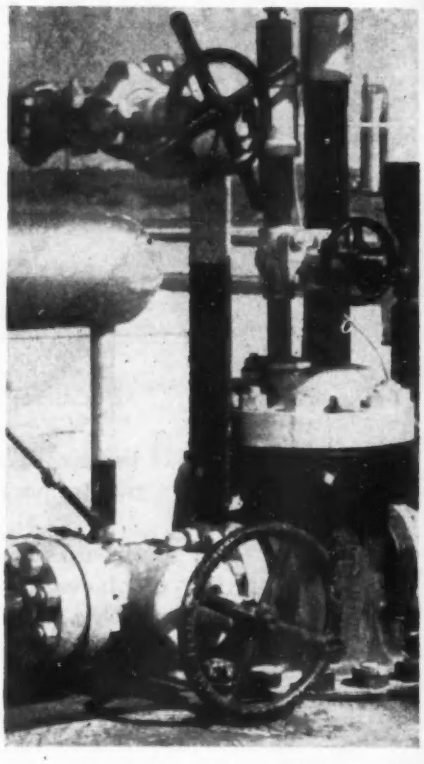
ZC739

required by the workover operation.

The tool box is of the weatherproof conventional design. It is made of sheet metal and equipped with a waterproof lid. Adjacent to the tool box and at the end of the skid is a work bench, to one end of which is mounted a pipe vise. The other end supports a large conventional blacksmith's vise. The work bench is welded to a horizontal section of pipe spanning the large skid. This member is detachable and is held in place by four peg bolts.

Plate Supports Bean Choke

Adjustable bean chokes mounted horizontally on relatively high-pressure connections from the christmas tree may be steadied and anchored firmly by means of a vertical beam support. Purpose is to prevent any possible leakage due to movement of the connections in the line when adjusting the choke and to support the flange when changing the choke body.



In the case illustrated, the well was dually completed and equipped with two strings of tubing. The smaller string of 1½-inch diameter pipe, was packed off through the tubing head as shown. On top of the gate valve is a swage nipple enlarging the flow line to two inches. The adjustable bean choke is mounted horizontally and flanged to the two-inch line. Because the smaller tubing extends from the tubing head where the 1½-inch pipe is packed off, the connections must be anchored firmly to minimize any chance of leakage around the packing due to movement of the assembly when the choke is being changed or adjusted.

A five-inch strip cut from a piece of steel floor plate measures about 30 inches long and contains two holes at each end. These holes fit over bolts extending through flanges; the top flange is on the adjustable choke and the bottom flange connects the side wing valve to the wellhead.

Careful inspection of this tree will show an interesting and unusual safety feature. The boards covering the cellar of this installation barely clear the wheels on each wing valve. The short hand extension on each wheel has been cut off so that when the valves are opened for any reason, the operator will not skin his fist by striking the timber planking. He must use the wheel in the conventional manner.

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Where conditions are particularly adverse—large fluid volumes, high power costs, distant service points—keep your profits and production UP with JENSEN UNITS.

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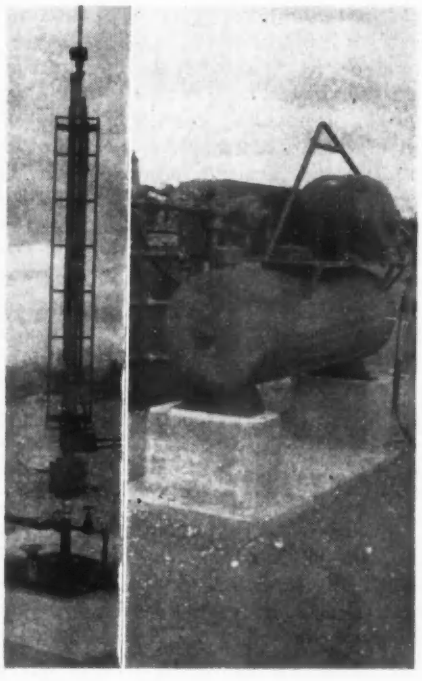

Ladder Speeds Pump Servicing

When equipping a shallow well with hydraulic pumping equipment, one operator installed a ladder on the master cylinder and a lift handle on the volume tank to speed up maintenance and to make lease operations more convenient. This type hydraulic pumping system is shown in the two illustrations. A remote gear pump is electrically driven and is mounted on top of a volume tank. The master cylinder of the hydraulic pump is directly on the tubing so that the polish rod extends above it and is packed off at the top by a bearing and packing element.

The ladder is made of sucker rod material and supported by two bracket clamps bolted around the bottom and upper part of the master cylinder. Purpose of the ladder is to speed up greasing the top bearing and adjusting the packing element. Previously, it was necessary for the pumper to carry a ladder on the pickup truck in order to make these adjustments.

The hydraulic fluid volume tank with the electric motor and gear-type pump are on concrete pedestals to provide a firm foundation and keep the equipment off the ground. Lag bolts secure the unit to the foundation. A steel rod in the shape of an A-frame is welded to the motor base for lifting the entire unit.

Anchor Rail Supports With Clamps

Drilling holes in the concrete pad, grouting-in or otherwise permanently anchoring guard rail supports for pumping unit enclosures no longer is necessary with the method devised by one producing company.

The idea involves the use of shop-made clamps, fabricated from short pieces of flat bar stock, which are so positioned as to permit their being attached to whatever structural members of the pumping unit framework or base that may be handy. In one of the C-clamp flats—preferably the inner- or under-side members so as to minimize any attempts by unauthorized persons to tamper with them—is drilled a hole that is tapped for a heavy hex-head set screw. The set screw is tightened down against the

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*To Ferrous Metals
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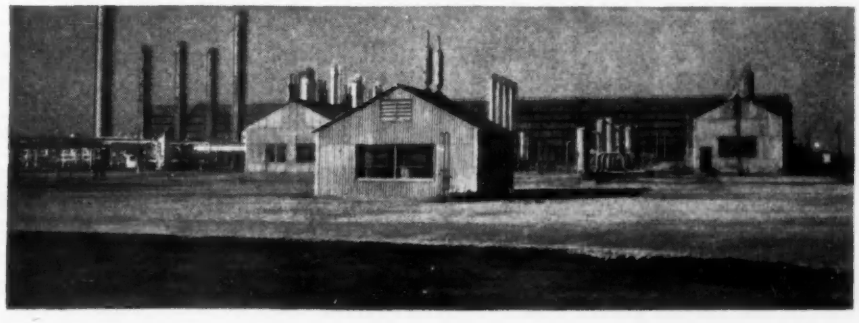

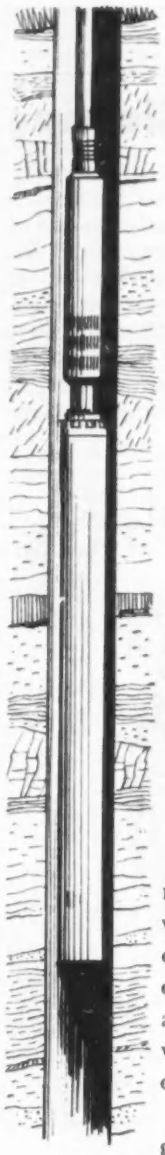

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With continually rising labor and investment costs, economy of operation is of paramount importance in producing wells with decreasing oil-water ratios.

Reda pumps are given consideration as original or replacement equipment because of their known performance in producing fluid at a *lower* cost per barrel, thus often extending the ultimate economic life of wells.

Improved engineering and design have increased operating life. Increased operating life means *lower* labor cost per barrel, *lower* investment cost per barrel, *lower* maintenance cost per barrel: *lower cost per barrel produced.*

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PRODUCTION HINTS

unit structure when the post is set up and plumbed.

Principal advantages of this method, aside from the fact that no drilling or cutting is required at each location, are that approximate measurements can be taken beforehand, and the unit can be built in the shop then assembled in the field with a minimum of wasted time. The nature of the clamp makes it possible to shift the unit a short distance in either direction to obtain the desired alignment, thus precluding the need for precise measurements. The ability to quickly dismount the guard railing to pull the well or perform other work, plus the nearly 100 percent salvageability of the railing, also can be considered advantages of this type of installation.

Corrosion Tests Simple to Make

Evaluation of the chemical corrosion of gas and gas condensate wells has been simplified by the use of a special coupon holder device that can be easily installed and removed from the wellhead assembly. This coupon can be placed in the flow stream so that it is subjected to the same corrosive environment as other metal parts exposed to the produced stream.

A special nipple installed on top of the christmas tree was equipped

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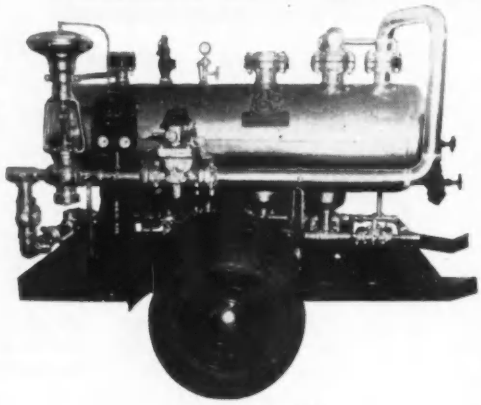
PERMANENT AND PORTABLE SEPARATORS FOR METERING OIL AND GAS



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6' 0" s. to s.; 24" dia.; 600# w.p.; 1450 bpd. oil; 9000 MSCFD gas; 600 bpd. water

This compact Wellchecker has facilities for metering both oil and gas. A tie-in line permits rejoining oil and gas after metering, if desired. No. 6H—2406 can also be furnished with automatic water knockout to remove and meter free water. Unit simplifies periodic well tests, gas/oil ratio tests, drill stem and potential tests. See Composite Catalog or write for illustrated Bulletin No. 1952-W.

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Physicals of Jones nickel alloy rods are improved by both normalizing and tempering.

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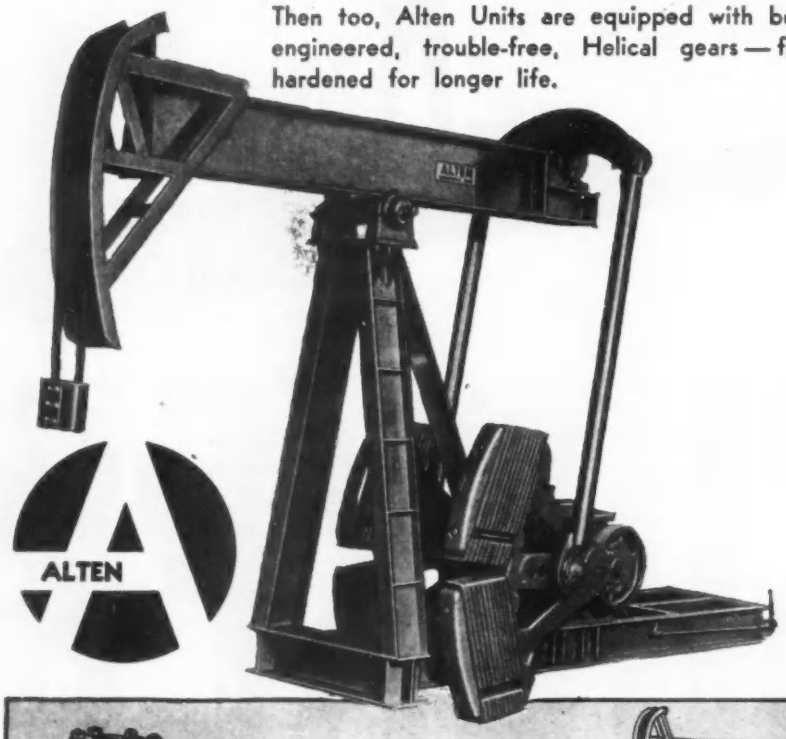
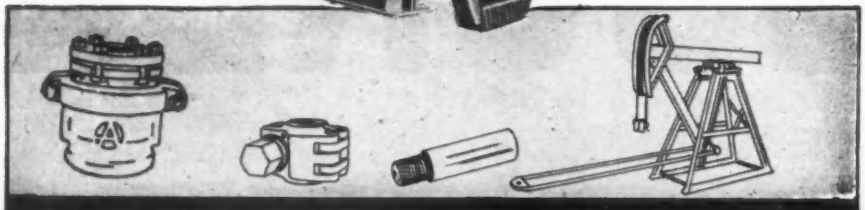
ALTEN pre-testing means much to you

More fluid . . . uninterrupted operation . . . lower maintenance costs. You get them all with Alten Pumpers because each must prove itself in severe factory tests before shipment.

Then too, Alten Units are equipped with better engineered, trouble-free, Helical gears — flame hardened for longer life.





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Gears are precision cut from finest alloy steel and shaved for perfect profile then flame hardened for highest surface hardness obtainable.

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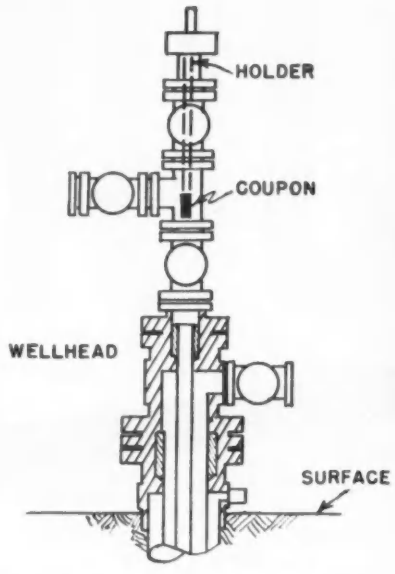


with a one-bolt union. This union cap supported an insulated holder that extended into the flow stream as shown in the schematic drawing. By insulating it from the remainder of the tree, it was not effected by extraneous electrical currents that would prevent an exacting analysis of the chemical corrosion phase of the problem.

A polished piece of mild steel about 1/16-inch thick was carefully weighed and measured before it was placed in the well stream. The master gate valve was closed, the upper valve was opened and the coupon and holder inserted in the well. When the cap was secured, the master gate was opened and the coupon exposed in the flow stream for about two weeks. After this period the coupon was removed and carefully examined. It was cleaned of any coatings and weighed. Any loss in weight could then be used as a guide in estimating the corrosion problem resulting from chemical action. The coupon revealed any protective coating deposited in the tubing and wellhead equipment.

Concrete Form Centers Unit

Part of the time spent in rigging up the portable mast pulling unit involves positioning the unit and the base of the mast, in exactly the right spot in front of the casing head. Much of the final adjusting, measuring and lining up can be avoided by advance planning at the time the concrete pad is poured around the well.

When specifications of the unit are known, including the size of the mast

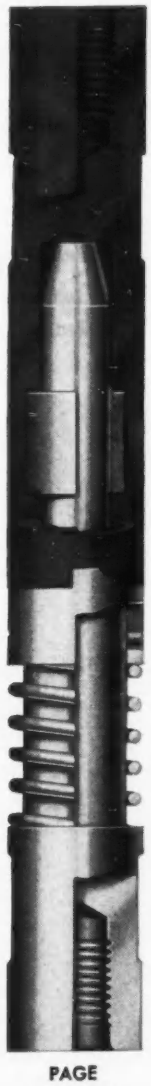
base, a form may be cast in the concrete which will enable the operator to spot the unit precisely, knowing that the mast, when positioned in the recessed area, will always be in place when lines are rigged up ready for pulling. The shallow depression does not interfere with other normal operations that might have to be performed on or around the wellhead.

New Tank Ladder Is Inexpensive

A sturdy tank ladder affording inspection of tank fluid level can be made at little cost from salvaged sucker rod material welded to the tank skid as shown. Temporary water tanks or test tanks require hooking up and frequent checking by the pumper or lease foreman, and it is necessary to provide a ladder for this purpose.

Here is a simple method of adding a ladder to the tank without impairing its mobility or making necessary other arrangements for one. Welding skids directly to the side of a tank for easy loading and unloading from trucks is an old but useful device. The skids protect the tank, are permanently affixed to the tank wall and facilitate transporting.

Since the skid beams are of four-inch pipe, one of the runners is used as support for the ladder rungs. The rungs are made of salvaged ¾-inch sucker rod, about 12 inches long, and separated about 12 inches apart. One end is welded to the skid and the other end to the tank wall as shown. The finished job makes a sturdy ladder that does not interfere with moving or loading the tank.



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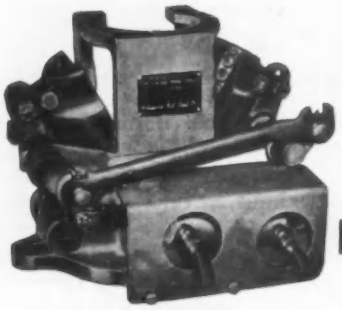

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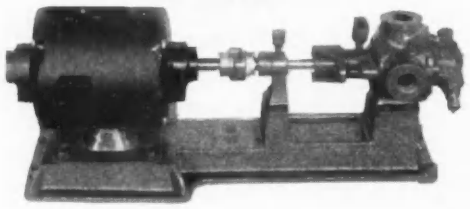

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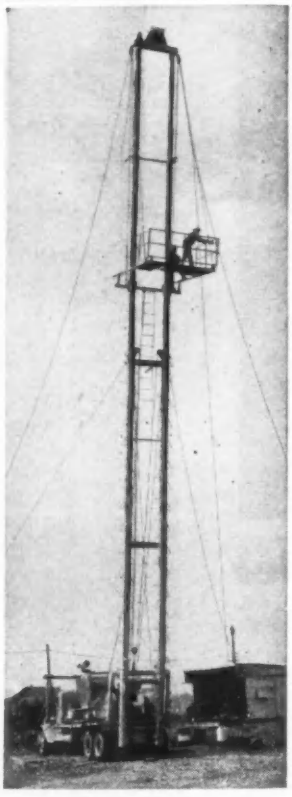

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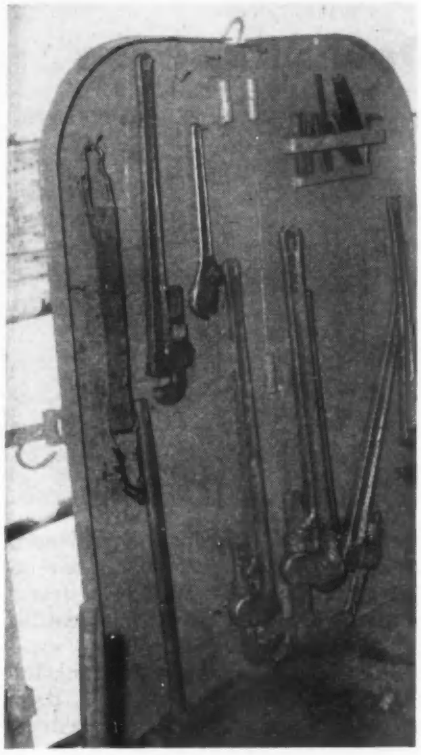

Folding Case Contains Tools

The old suitcase idea was used to construct a portable tool rack for handling small hand tools on a well pulling unit or small maintenance rig. The tool case is made of sheet metal and contains two folding sections that can be closed and locked for transport. Not only are the small hand tools stored in a place where they can be located, but the case prevents their loss.

A back rib measuring about five inches wide by four feet long is equipped with a lifting bail and hinged at three points to each of two folding sides. Each side is about 30 inches wide, flat on bottom and curved on the outer edge at top. A 2½-inch lip is welded to the edge of both sides so that when closed, the sides meet to form a case or box.

When both sides are closed, a heavy-duty hasp welded to the outer edge of one door fits over a matching eye welded to the second side. A lock can then be placed on the closed case to prevent pilfering of small hand tools during transport or storage. Nail stubs welded to the inside panels form hooks on which the hand tools may be hung. A small bin at one side provides storage for smaller tools such as chisels, etc. Such a tool case speeds setting up equipment.

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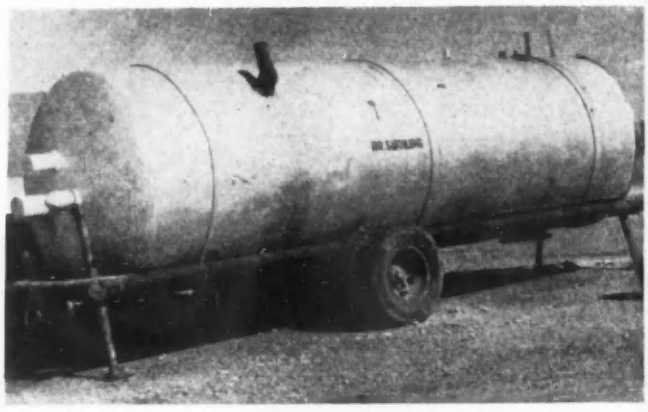


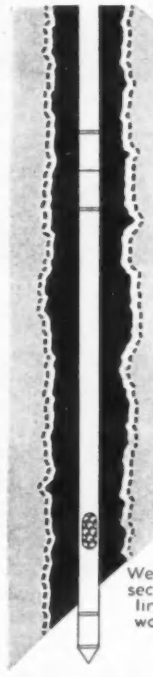
Considerable time and expense in the erection of well testing tanks can be saved by fabricating a special mobile unit. Here is one possible solution to the problem, and one that has proved itself in field use.

The tank shown here is a salvaged heater-treater that was cleared of all chambers inside so that it could be used for well testing purposes. It was mounted on a single axle, four-wheel trailer, making it possible to carry the tank, when empty, to any part of the field.

All openings on the tank are sealed, except those necessary for the inlet, outlet and breather connections. The trailer bed is made of three-inch pipe welded into a rectangle measuring just a few feet longer than the tank, the width being equal to about half the diameter of the vessel.

The axle is supported on pillar blocks to raise the tank above it. These blocks are attached directly to the three-inch pipe frame. The tank is laid horizontally on the frame and anchored in three places by salvaged sucker rod material. The rods are inserted through holes in the pipe frame and threaded so the tank can be tightened down securely.

To take the weight of the tank full of liquids off the four wheels, there are supporting jacks at each corner of the pipe frame. These jacks are nothing more than telescoping pieces of pipe: a piece of 2½-inch pipe is welded to the frame and a longer section of 2-inch pipe inserted inside it. Set screws are welded near the top of the sloping 2½-inch pipe section in order that the tank may be stabilized in position. As the tank is filled, the tires are flattened until the four legs take part of the load.



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Well bore cross section. Dotted lines indicate wall reaming.

Cross section view of torpedo

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Corrosion, reduction of contactor capacity among problems met by El Paso Natural in

Operating Glycol-Amine Gas Treating Plants

By MACK ATCHESON and A. A. COHN
El Paso Natural Gas Company

CORROSION was the principal problem encountered by El Paso Natural Gas Company in removing an average of 9 million cubic feet per day of carbon dioxide and 4½ million cubic feet per day of hydrogen sulfide at glycol-amine gas treating plants in the Permian Basin during 1951.

Other major problems being combated by El Paso in removing a steadily increasing amount of hydrogen sulfide containing the equivalent of more than 60,000 long tons of sulfur per year are:

- Reduction of contactor capacity due to accumulation of corrosion products in the bubble cap.
- Glycol-amine solution deterioration.
- Loss of solution.

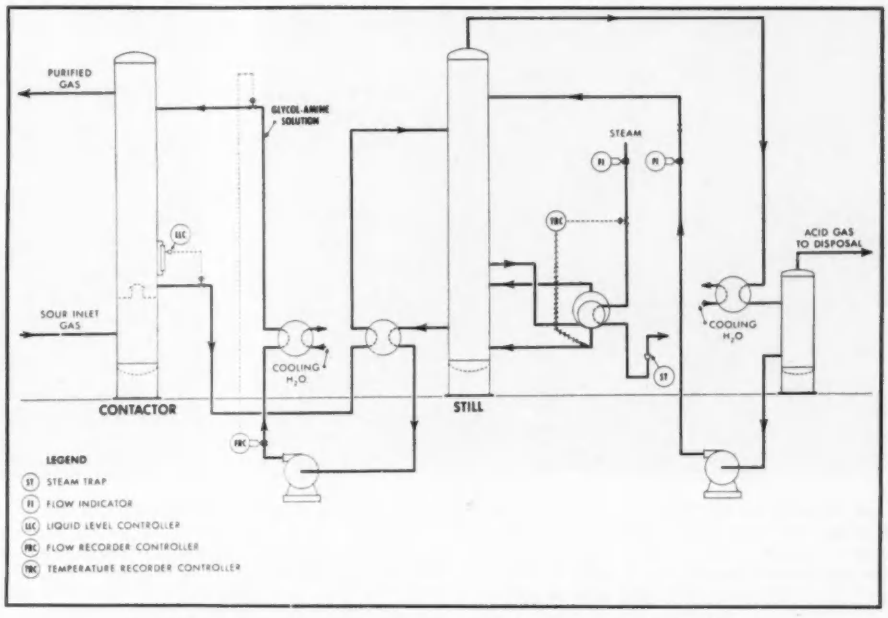


FIGURE 1. Flow diagram of a typical glycol-amine gas treating plant. (Courtesy of Fluor Corporation.)

Glycol-Amine Process

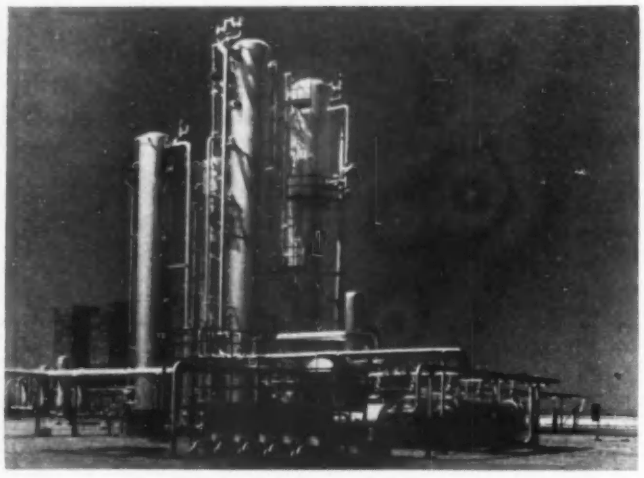
The glycol-amine process is designed for both gas purification and dehydration. The dehydration takes place because the solution contains only a minor portion of water. The solution is composed mainly of diethylene glycol (DEG) and monoethanolamine (MEA). Monoethanolamine is a basic organic compound which reacts with acid gases. The compound formed by the reaction of monoethanolamine and the acid gas when heated will decompose to liberate the acid gas and restore the amine to its original form. This is the basis for the process. According to Kohl and Blohm,[1] the reactions involved in a glycol-amine plant are somewhat different from those involved in a treating plant employing an aqueous amine solution. It is therefore, not surprising that some of the operating problems are considerably different in the two plants.

Figure 1 shows a flow sheet of a typical glycol-amine gas treating plant. The sour natural gas flows upward through a bubble tray column called a "contactor," where it is contacted with a glycol-amine solution, normally containing 5 percent water, 20 percent MEA, and 75 percent DEG. The solution removes the hydrogen sulfide and carbon dioxide from the natural gas, and likewise removes a large portion of the water. The solution leaving the contactor flows through a heat exchanger and enters the still.

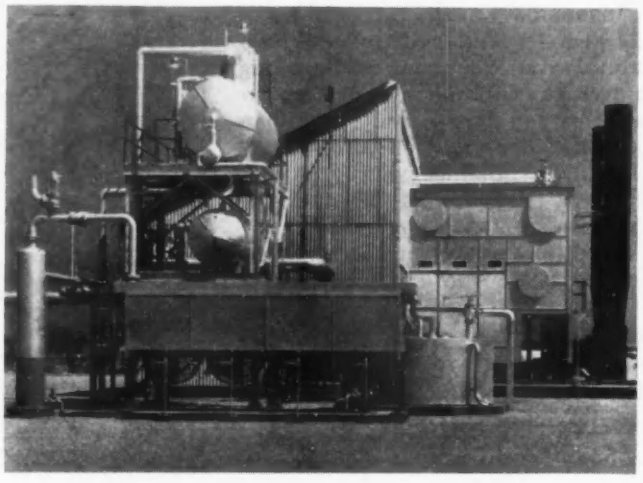
The solution flowing downward through the still becomes hotter and is subjected to the stripping action of vapors rising from the reboiler. The solution leaves the still almost completely stripped of acid gas and enters the reboiler. The solution is further heated in the reboiler. This removes the remainder of the acid gas and lowers the water content to the desired concentration. The solution then flows through the heat exchanger and is pumped through coolers into the contactor. The acid gases which were stripped from the solution in the still leave the top of the still and flow through a partial condenser where the major portion of the water in the acid gases is condensed. This water is collected and used for reflux in the still. The cooled acid gas is sent to a sulphur recovery plant or is disposed of by burning in a flare.

Operating Problems

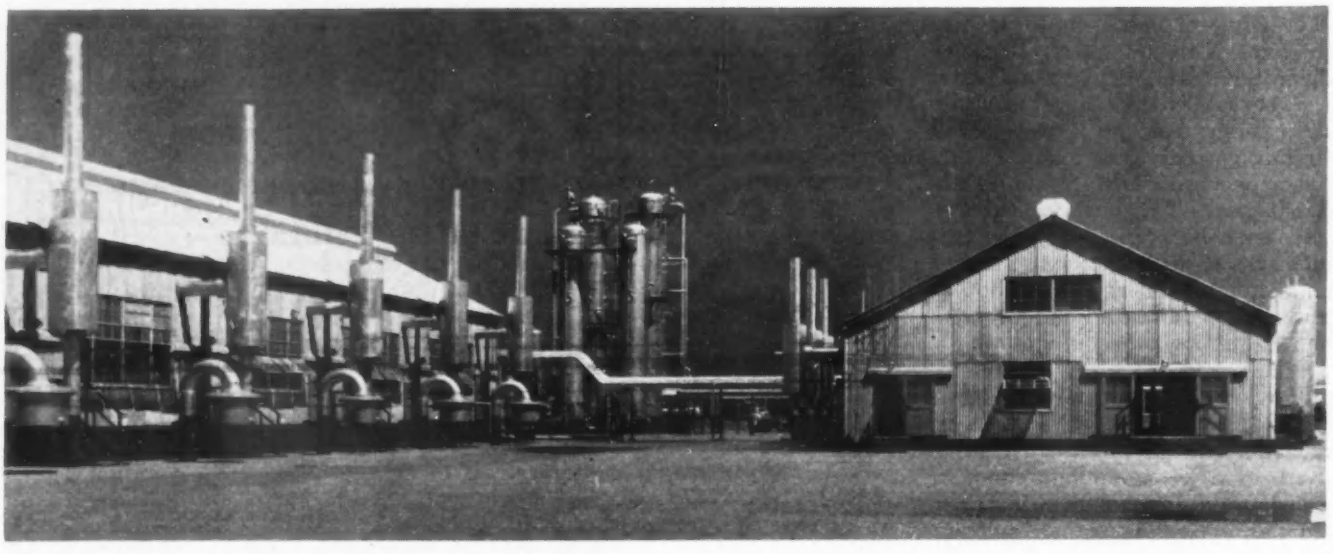
The material which has been used most often in the construction of treating plant equipment is carbon steel. The rate of corrosion of carbon steel increases rapidly with increasing temperature. Laboratory tests and actual observation of corrosion failures have indicated that relatively high mole ratios of acid gas to monoethanolamine will give high rates of corrosion. It has been observed that high velocities cause relatively high rates of corrosion. In fact, any removal of the corrosion product by mechanical means increases corrosion. It has been observed that high rates of corrosion exist where there is a mixture of liquid and vapor present. This is especially true where the gas is evolved in the particular location. It is believed that solutions containing large amounts of hydrogen sulfide relative to CO_2 is more corrosive, all other things being equal, than



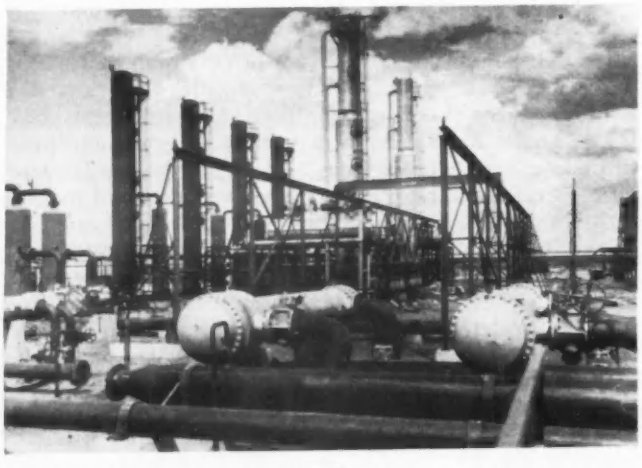
View of contactor and still at El Paso Natural's Jal No. 3 combination treating and compressor plant. Reboiler and heat exchangers are in foreground. Small tower at left is absorber tower unit through which lean oil from distant Jal No. 2 plant circulates to pick up gasoline from the natural gas.



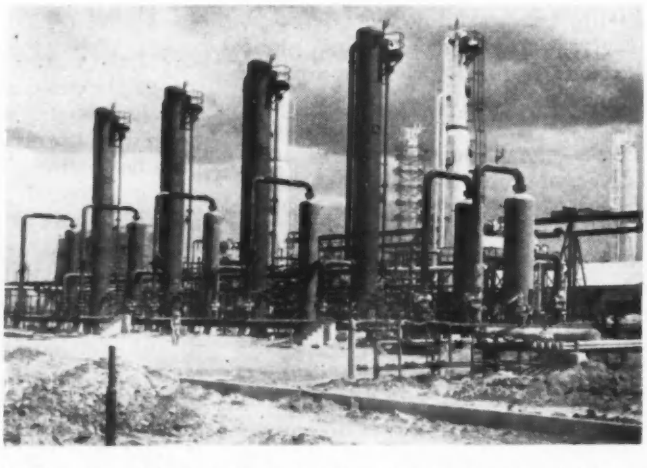
Boilers at Jal No. 3 plant generate steam for reboiler and still in treating plant. The steam is used to drive moisture, hydrogen sulfide and carbon dioxide from glycol-amine solution. This is the solution which absorbs virtually all of the impurities from the gas as it bubbles through in the contactor towers.



Compressor and auxiliary buildings at Jal No. 3 plant with the treating towers in background. This plant is highly automatic. Only 15 men are required to man the entire plant. Two operators are constantly on duty. They can easily look after the seven compressors, auxiliary engines, boiler plant, treating plant and cooling towers and atmospheric coolers.



Jal No. 4 plant started operations early last month, although construction was not complete. This plant and the San Juan plant in northern New Mexico are the two largest natural gas treating plants in the world. At left are the four contactors which remove hydrogen sulfide, carbon dioxide, and water from the gas. Tall vessels in the background are stills which purify the glycol-amine solution.



Another view of the Jal No. 4 plant. Scrubbers beside each of the contactors are used to collect entrained solution carried over from the towers. This plant is one of a number of combination treating gasoline plants owned by El Paso Natural. It is estimated that the company will recover 75 million gallons of gasoline, 25 million gallons of propane, and 20 million gallons of butane per year when present plans and increases pending before FPC have been completed.

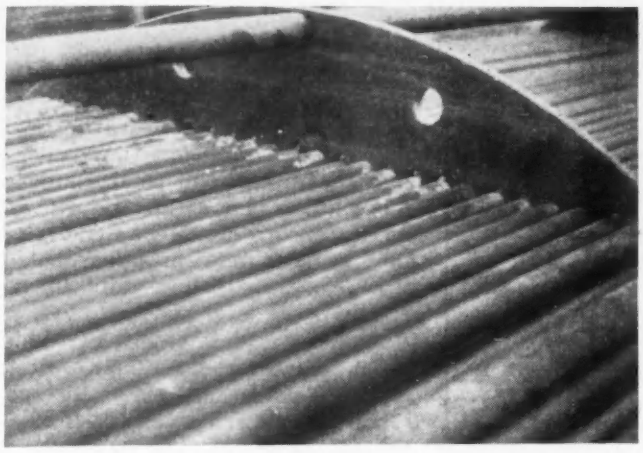


FIGURE 2. Carbon steel reboiler bundle. Note enlargement of holes in support plate.

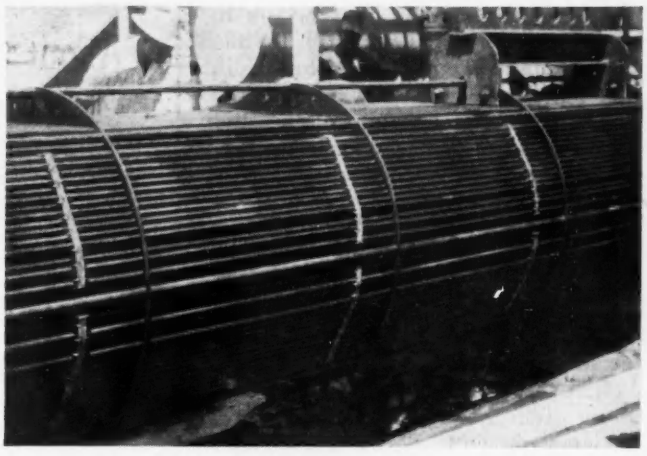


FIGURE 4. Straps jammed between tubes to prevent movement of tubes in reboiler bundle.

a solution containing relatively small amounts of H2S relative to CO_2. The presence of stresses are believed to increase corrosion rates.

Solution exchangers have been the portion of the plant which has been most severely attacked by corrosion. Carbon steel tubes in this service were usually corroded uniformly over the entire tube, however, large pits were found in some cases, especially where the corrosion was relatively light. Heat exchangers which were arranged so that the rich solution would flow through the tubes and the lean solution would flow through the shell were apparently less subject to corrosion than those in which the lean solution would flow through the tubes and the rich through the shell. Solution exchangers arranged so that the rich solution would flow in the shell were sometimes found to be almost completely plugged when inspected after a period of operation.

The solution leaving the contactor contains a small amount of hydrocarbon gases. Some of this gas is absorbed by the solution, while the remainder is entrained in the solution. The amount of these hydrocarbon gases in the solution varies with the contactor pressure. The major portion of the gases absorbed in the solution flash when passing through the liquid level control valve, so that the feed to the exchanger is actually a mixture of vapor and liquid. It was observed that one plant, whose contactor pressure was especially low, did not have the corrosion problems which some of the others had. Separators have been installed in many of the plants to remove the major portion of the hydrocarbon gases in the solution from the contactor. This prolonged the life of the heat exchanger tubes somewhat. The most important advancement in the design

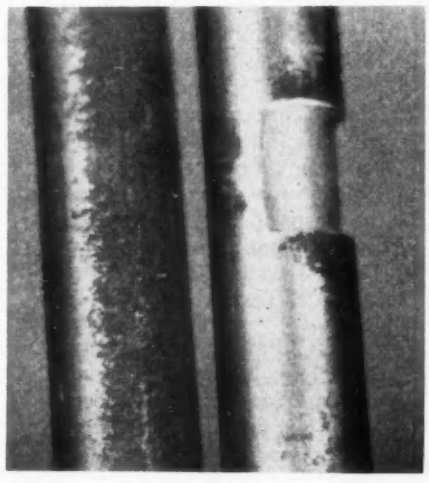


FIGURE 3. Aluminum reboiler tubes. Notch in tube shows the location of support plate. Black deposit on tubes was hard to remove.

of solution exchangers is the use of aluminum tubes. Laboratory tests followed by pilot scale tests indicated definitely that aluminum tubes should last considerably longer than carbon steel tubes. This has been borne out in actual operation. An aluminum bundle was installed in a plant whose carbon steel bundles had been lasting only a little longer than six months and has been in service for two years without failure. Aluminum bundles installed in a plant whose carbon steel exchangers lasted less than four months have been in service for almost 1½ years with no failures. A 4-6 percent Cr—½ Mo tube bundle had been in service in this particular plant for almost 1½ years and was in good shape when removed. Also used successfully in heat exchanger service is 18-8 stainless steel. However, these alloys are much more expensive than aluminum. The aluminum bundles show less tendency to become fouled than either carbon steel or 4-6 chrome.

TABLE 1
Wall Thickness of Treating Plant Still After 32 Months on Stream

TRAY	
3	0.393"
4	0.386"
5	0.380"
6	0.380"
Feed Point	
7	0.163"
8	0.168"
9	0.161"
10	0.322"
11	0.327"
13	0.332"
14	0.374"
15	0.374"

Measurements were made approximately four inches above floor of tray.

Stills in two plants have failed due to corrosion. In both of these plants, there is a possibility that oxygen was allowed to contaminate the solution. There is no doubt, however, that the stills are being attacked by corrosion in the absence of oxygen. Table 1 gives the wall thickness of a still after 32 months in service. The trays are numbered from top to bottom. The feed point is on the seventh tray. The original wall thickness was .375 inches.

In order to reduce the concentration of acid gases around the still feed point, separators have been installed in several of the plants to remove the vapor from the still feed. This vapor is fed into the still several trays above the liquid feed point. It has been found advantageous to distribute the still feed over a large area of the tray and prevent it from splashing on the walls of the vessel. An aluminum liner has been installed in one of the stills and extends from two trays above the feed point to four trays below the feed point. This liner has been in operation for nearly 1½ years and is apparently in excellent condition.

Reboilers in glycol-amine gas treating plants are not normally subject to

the general corrosion that occurs in the heat exchangers and stills. While the temperature of the solution in the reboiler is much higher than the solution at the feed point of the still, it is less corrosive because most of the acid gas has been stripped from the solution in the still. The feed to the reboiler normally contains less than .05 of a cubic foot of acid gas per gallon of solution. In plants in which the reboiler feed contains more than .05 cubic feet per gallon pitting has occurred.

The type of corrosion which has most often been experienced in reboilers is shown in Figure 2. Evidently the boiling liquid causes a movement of the tubes. The tube wall thickness is reduced underneath the support plates and the holes in the support plate are enlarged. It is believed that this is a combination of mechanical wear and corrosion. The tubes in many cases are perfectly smooth except under the support plate.

Figure 3 shows an aluminum tube which was in service in a reboiler and shows that aluminum is likewise subject to the same type of corrosion and mechanical wear. In order to reduce the movement of the tubes, replacement bundles have been made with wider tube spacing. In some of the plants, rows of tubes have been omitted as an expedient, in order to provide lanes for vapor to pass through the bundle without disturbing the tubes. Figure 4 shows another expedient which has been used in an attempt to hold the tubes tightly.

The normal life of carbon steel reboiler tubes has been one and one-half to three years. Aluminum tubes have given somewhat shorter life, but are less subject to general corrosion. Most observers agree that this problem is one of design. Several promising ideas are being tried, but no solution has been found.

Another problem which has been troublesome at a few of El Paso's plants has been the reduction of capacity of the contactor due to accumulation of corrosion products in the bubble caps. At first, this was remedied by acidizing. Later, detergents and hot water were used successfully. However the frequency of cleaning was considered too great. The bubble caps were modified to increase the slot width, thereby reducing the tendency of the corrosion products to accumulate. This has practically eliminated the necessity of cleaning the contactors.

Over periods of long use the solution has deteriorated to form high boiling ends. This has increased the viscosity as high as 20 percent or more in some cases. A solution reclaimer was designed and put into operation to boil off and condense the solution from the high boiling constituents and corrosion products. The reclaimed solution is then returned to the system. The reclaimer effectively removes these high boiling ends and maintains the viscosity at a reasonable figure. Originally, the reclaiming was done at atmospheric pressure, but the high base temperature, i.e. 460 to 490° F., which is considerably above the decomposition temperature of diethylene glycol, made it advisable to operate the reclaimer under a vacuum. Operation of the reclaimer under vacuum removes a larger percent of the impurities.

This reclaimer has also remedied the filtration problem. It is believed that the presence of solid matter in the solution acts as an abrasive and increases corrosion. The removal of this solid matter was a particularly troublesome problem until the reclaimer was developed.

Another operating problem which is considered serious is the loss of solution. The major part of the solution losses can be traced to losses in the natural gas leaving the contactor. Part of this loss is due to mechanical entrainment of the liquid particles in the gas stream. The remainder of the solution losses in the gas stream are due to vaporization. It has been found by experiment that these vapors and liquid particles can be removed effectively by the use of a solid desiccant. The capacity of this solid desiccant is high and the size of bed required is relatively small. Some water vapor is present in the natural gas leaving the contactor and is picked up by the dry bed. The solid desiccant continues to remove the solution long after it has been saturated with water. The collection of these solutions in various parts of the pipe line have reduced the pipe line efficiency. Arrangements are being made to have all of the gas which enters the pipe line go through a solid desiccant in order to remove the solutions. These solutions will be recovered and returned to the plants.

About the Authors

Atcheson

Cohn

MACK ATCHESON joined El Paso Natural Gas Company in 1949 as a process engineer. Prior to that he was with Elliott Company of Jeannette, Penn., in the Research and Development department. He helped develop low temperature oxygen process plant, natural gas liquefication and nitrogen removal plants. From 1942 to 1946 he was a training officer in the Corps of Engineers. He graduated in chemical engineering from Texas Tech in his home town of Lubbock, Texas.

A. A. COHN is division engineer of El Paso Natural's Permian division. He joined the company in 1936. His first duties were to set up and operate a control laboratory. Cohn graduated from Texas A. and M. with a degree in chemical engineering in 1933. Prior to joining El Paso Natural, he worked in the Gulf Refining Company experimental laboratory in Port Arthur, Texas. During World War II he was a captain in the Corps of Engineers, serving in the Pacific Theater.

ACKNOWLEDGMENT

The authors wish to thank the various members of the Operating and Engineering departments of El Paso Natural Gas Company, without whose help the problems described above could not have been analyzed and solved. We also wish to thank the various members of The Fluor Corporation and the Griscom-Russell Company who have had a direct hand in the solution of the corrosion problems. Finally, we wish to express our appreciation to the El Paso Natural Gas Company for permission to publish this paper.

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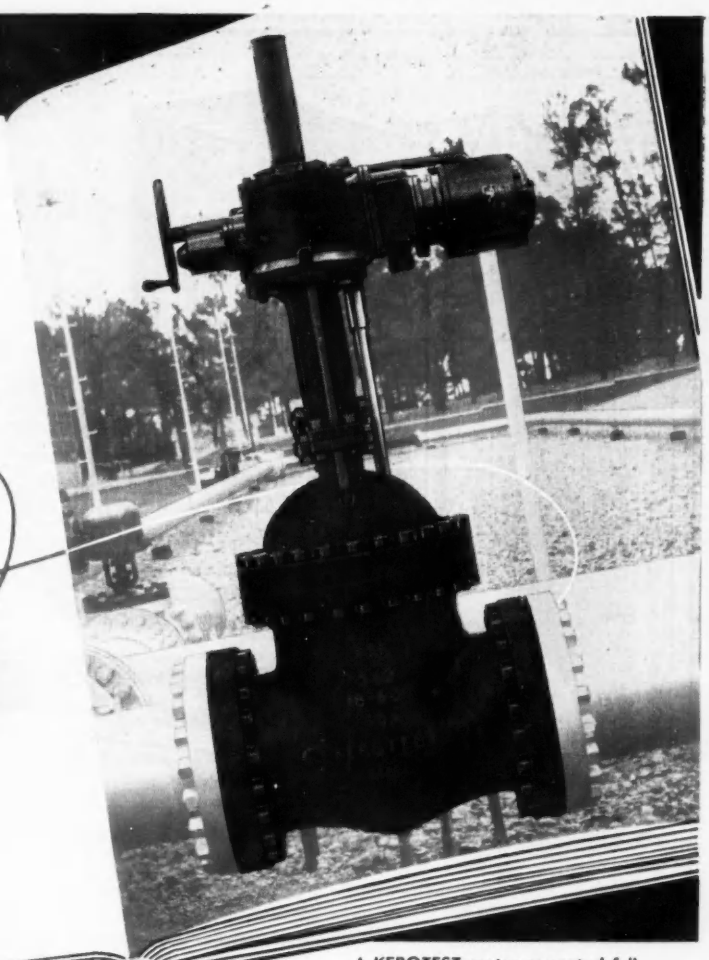

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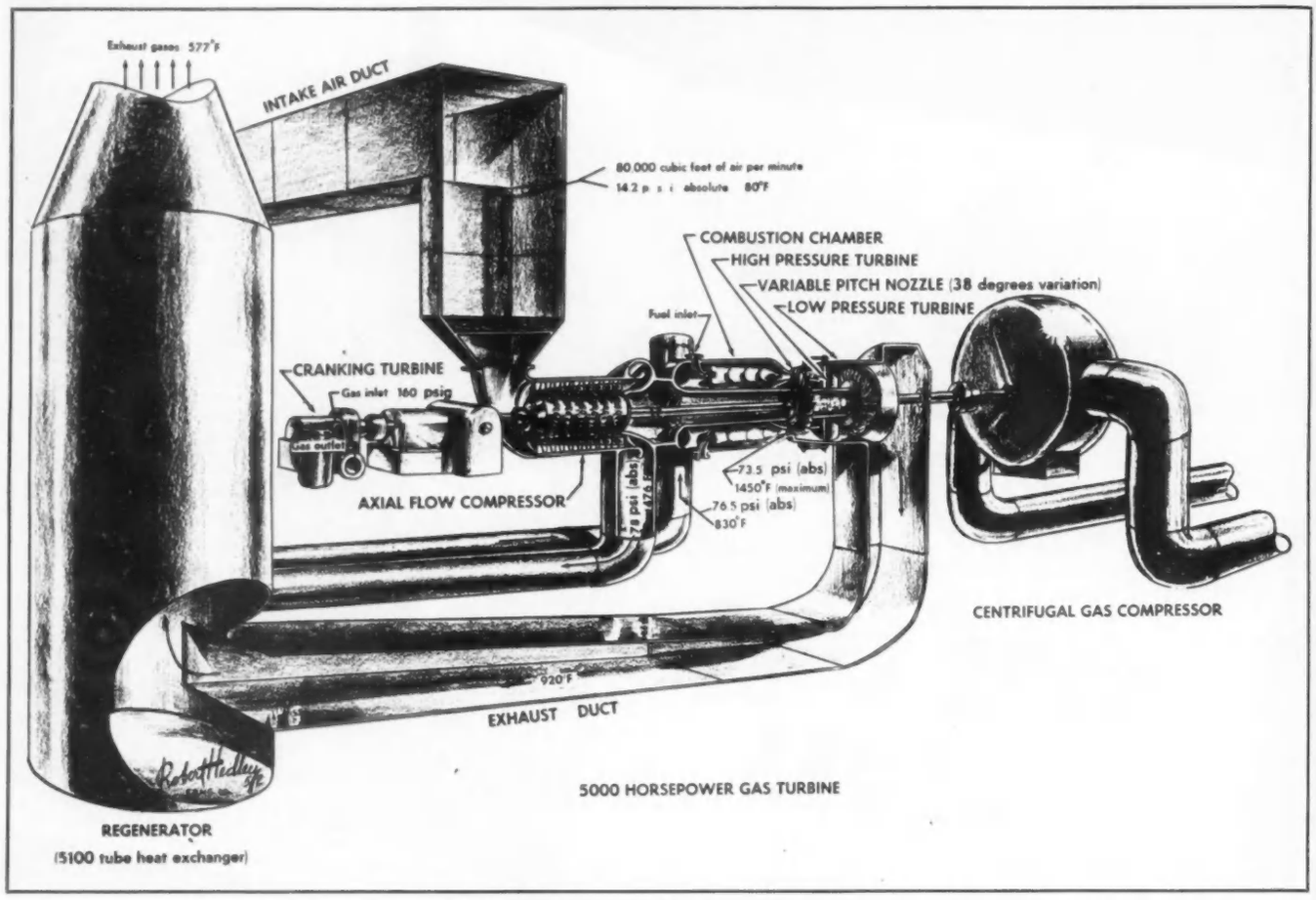


FIGURE 1. Schematic drawing of regenerative gas turbine cycle. Axial flow compressor high pressure turbine develops approximately 15,000 horsepower to compress air. Low pressure load turbine at left develops 5000 horsepower from hot gas exhaust from high pressure turbine.

Something New in Compressor Stations

- **5000 horsepower gas turbines.**
- **Large basement blowers cool concrete foundations.**
- **Water in steel supports avoids any overheating.**
- **And there are miles of electrical wiring.**

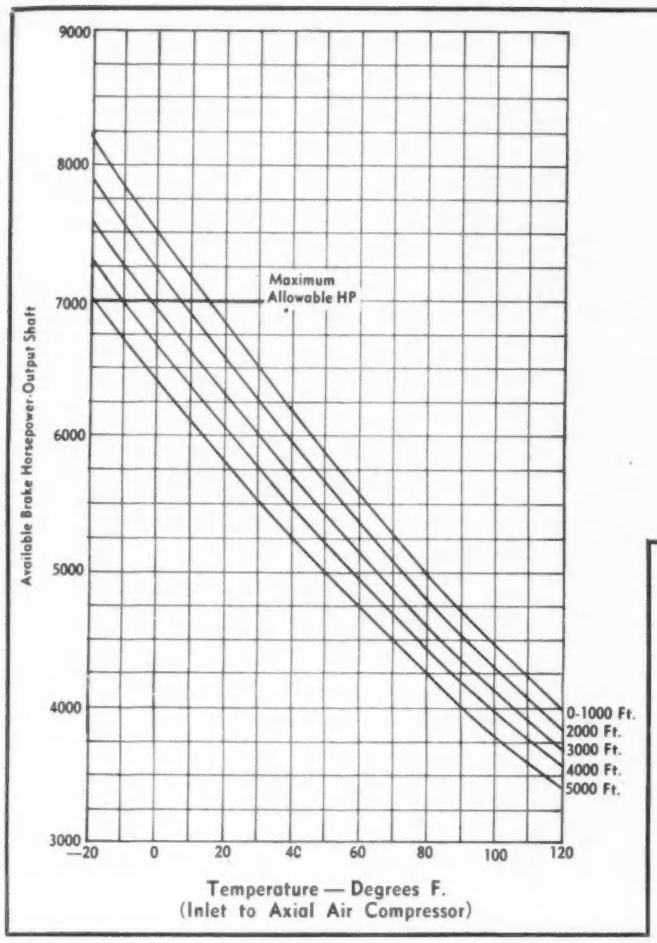
By C. L. MOORE and CARLTON HOMAN, JR.
El Paso Natural Gas Company

WITH AN operating force of only five men to watch after it, the first of El Paso Natural Gas Company's gas turbine compressor stations went on stream last month. The station is located at Cornudas, Texas. It has two turbines which together develop 10,000 horsepower. A third turbine is being added to bring the total station horsepower to 15,000.

To pipeliners familiar with conventional equipment, the new stations offer a number of surprises. For example, there are large basement blowers, whose sole function is to cool the concrete turbine foundations. There are water courses through the steel turbine supports; through them, cooling water circulates to keep the supports from getting too hot. And there are miles of electrical wiring attached to each turbine.

Yet, despite all of these innovations, most pipeliners have been predicting that the turbine would be successfully adapted for pipe line use. It has had a great backlog of successful service in other industries and in aircraft. The only problem was to make certain modifications to fit it to pipe line work.

The early turbine had a single shaft which linked all moving parts. An axial-flow compressor was at one end. The load was at the other. Between them was a turbine which supplied torque to the shaft. This simple system failed to measure up to pipe line requirements. Its thermal effi-



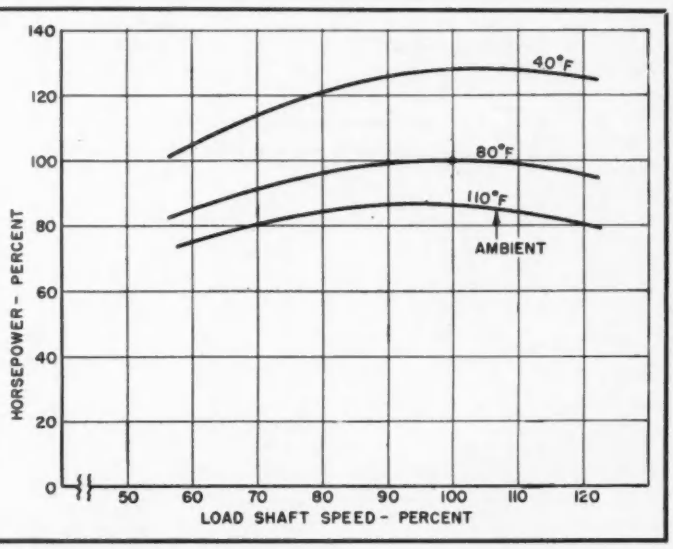


FIGURE 2 (left). Approximate continuous load shaft horsepower versus inlet temperature of air for different altitudes at optimum speeds for 500-horsepower turbines on El Paso Natural Gas Company system.

FIGURE 3 (above). Horsepower-speed characteristics variation with ambient temperatures of inlet to axial compressor. Turbine was designed to develop 5000 horsepower with 25 percent thermal efficiency based on low heat value of gas as 1020 Btu.

ciency was only 17 percent and when the speed fell off as much as 40 percent, load capability vanished.

The first change made to the turbine to adapt it to compressor station use was to split the shaft. This permits the air compressor end of the turbine to operate independently of the gas compressor end. It makes the machine flexible and the speed of gas compressors can be varied from 2000 to 5500 revolutions per minute.

A second change was to add a regenerator. This is a large shell and tube heat exchanger which enables compressed air to capture the heat of exhaust gases. It increases thermal efficiency from 17 to 25 percent.

Yet another important change was made in the turbine to adapt it to pipe line use. An air washer was added to the air intake to serve a dual purpose—wash the air free of dust and cool the air by evaporation for summertime operation. The logic of this addition is shown by curves in Figures 2 and 3. Notice how horsepower varies widely with inlet air temperature. For example, in Figure 2 at 80° F. and altitude of 1000 feet, the turbine produces 5000 hp or 100 percent load. At 120° F. the turbine can produce only 4000 hp, while at 40° F. it produces 6300 hp or approximately 125 percent of rated load.

Here's how the air washers can counter the loss of efficiency due to high summertime temperatures. For example, on a 100° F., 20 percent relative humidity day, the wet bulb temperature is approximately 69° F. Since the evaporative cooler can approach within three degrees of wet bulb temperature, it will lower the temperature to 72° F. From the curve it can be seen that this will increase hp from about 4500 to about 5300, or from about 90 percent of rated load to about 105 percent.

As can be seen in Figure 2, altitude greatly affects turbine output. While little could be done to lower altitude of stations, the turbines were sized to give sufficient output to carry the load.

The gas turbines installed in stations recently completed by El Paso Natural Gas are rated at 5000 hp, 5000 rpm, 80° F. ambient temperature, 1000 feet elevation, with a thermal efficiency of approximately 25 percent based on the lower heating value of the fuel. The machines are designed to be able to increase load shaft speed to 5500 rpm. Since the hp characteristic of the gas turbine is very flat in vicinity of maximum rating Figure 3 the compressor can be designed to absorb approximately 5000 hp at any speed ranging from 4000 to 5500 rpm.

The compressor selected for the stations can develop 5000 hp at 4500 rpm. In the winter time it can be speeded up to absorb 6300 hp which comes with an ambient temperature of 40° F.

Efficiency-wise the turbines were designed to obtain approximately 25 percent efficiency with a regenerator efficiency of approximately 80 percent. This should give a full load consumption of approximately ten cubic feet of gas per brake hp hour, figuring the fuel at a lower heating value of 1020 Btu per cubic foot. Likewise, with a low limit design of 4500 hp, the fuel will run about 10.5 cubic feet, per horsepower hour.

Figure 1 shows a schematic of the regenerative cycle of a 5000 hp gas turbine. Starting at left, about 80,000 cubic feet of air per minute (or 90.7 pounds per second) enters the air washer. From there it flows with slight pressure drop to the multibladed axial flow compressor which is the heart of the gas turbine. Its function is to raise pressure of incoming air to the highest point in the cycle,

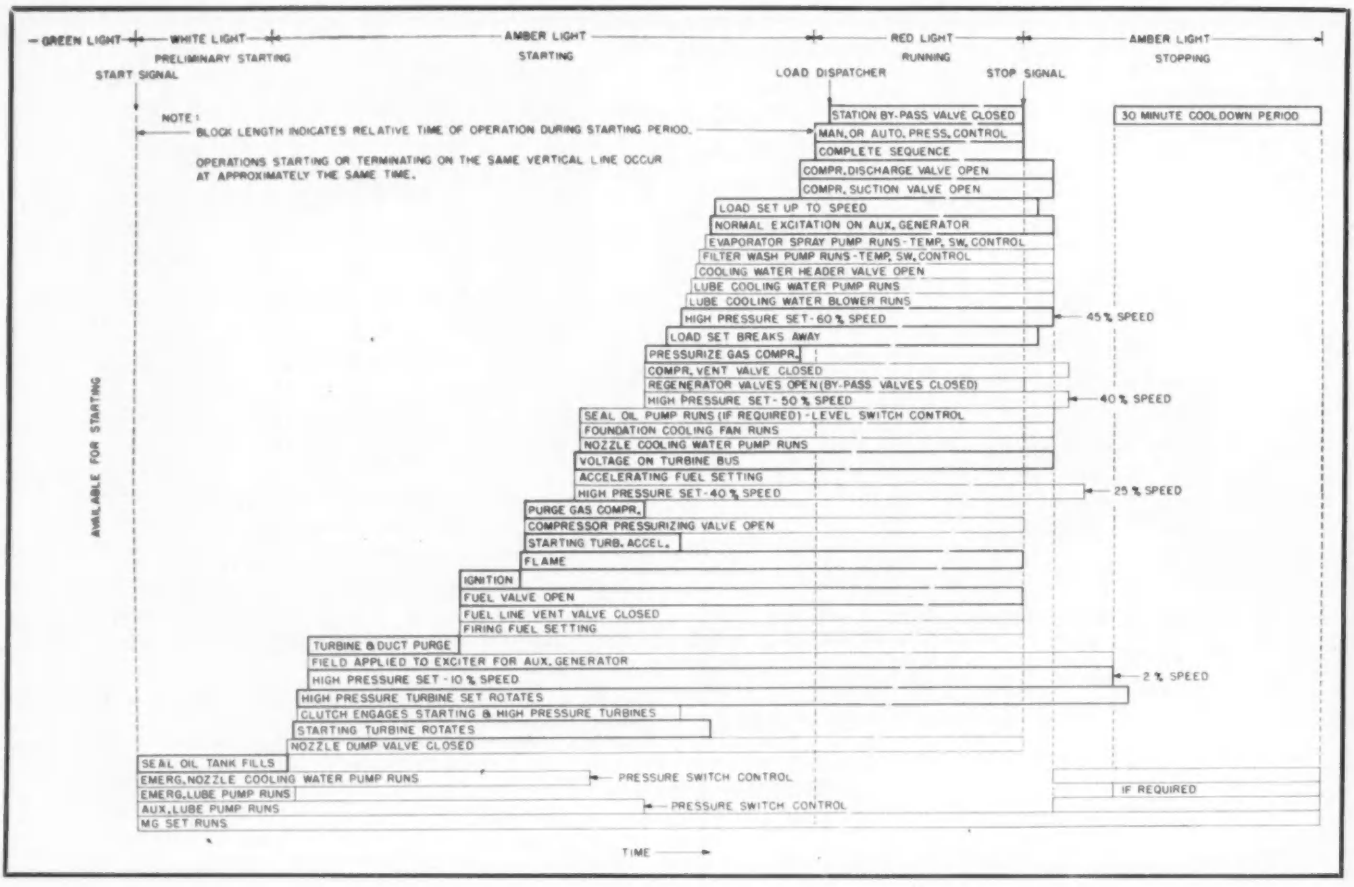

GREEN LIGHT
START SIGNAL
WHITE LIGHT
PRELIMINARY STARTING
AMBER LIGHT
STARTING
RED LIGHT
RUNNING
LOAD DISPATCHER
STOP SIGNAL
AMBER LIGHT
STOPPING
NOTE:
BLOCK LENGTH INDICATES RELATIVE TIME OF OPERATION DURING STARTING PERIOD.
OPERATIONS STARTING OR TERMINATING ON THE SAME VERTICAL LINE OCCUR AT APPROXIMATELY THE SAME TIME.
AVAILABLE FOR STARTING
STATION BY-PASS VALVE CLOSED
MAN. OR AUTO. PRESS. CONTROL
COMPLETE SEQUENCE
COMPR. DISCHARGE VALVE OPEN
COMPR. SUCTION VALVE OPEN
LOAD SET UP TO SPEED
NORMAL EXCITATION ON AUX. GENERATOR
EVAPORATOR SPRAY PUMP RUNS - TEMP. SW. CONTROL
FILTER WASH PUMP RUNS - TEMP. SW. CONTROL
COOLING WATER HEADER VALVE OPEN
LUBE COOLING WATER PUMP RUNS
LUBE COOLING WATER BLOWER RUNS
HIGH PRESSURE SET - 60 % SPEED
45 % SPEED
LOAD SET BREAKS AWAY
PRESSURIZE GAS COMPR.
COMPR. VENT VALVE CLOSED
REGENERATOR VALVES OPEN (BY-PASS VALVES CLOSED)
HIGH PRESSURE SET - 50 % SPEED
40 % SPEED
SEAL OIL PUMP RUNS (IF REQUIRED) - LEVEL SWITCH CONTROL
FOUNDATION COOLING FAN RUNS
NOZZLE COOLING WATER PUMP RUNS
VOLTAGE ON TURBINE BUS
ACCELERATING FUEL SETTING
HIGH PRESSURE SET - 40 % SPEED
25 % SPEED
PURGE GAS COMPR.
COMPRESSOR PRESSURIZING VALVE OPEN
STARTING TURB. ACCEL.
FLAME
IGNITION
FUEL VALVE OPEN
FUEL LINE VENT VALVE CLOSED
FIRING FUEL SETTING
TURBINE & DUCT PURGE
FIELD APPLIED TO EXCITER FOR AUX. GENERATOR
HIGH PRESSURE SET - 10 % SPEED
2 % SPEED
HIGH PRESSURE TURBINE SET ROTATES
CLUTCH ENGAGES STARTING & HIGH PRESSURE TURBINES
STARTING TURBINE ROTATES
NOZZLE DUMP VALVE CLOSED
SEAL OIL TANK FILLS
EMERG. NOZZLE COOLING WATER PUMP RUNS
PRESSURE SWITCH CONTROL
EMERG. LUBE PUMP RUNS
IF REQUIRED
AUX. LUBE PUMP RUNS
PRESSURE SWITCH CONTROL
MG SET RUNS
30 MINUTE COOLDOWN PERIOD
TIME

FIGURE 4. Control sequence diagram for El Paso Natural's gas turbines. During first start-up these operations were performed manually. Future start-ups will use automatic controls with time delay relays and instruments controlling this sequence.

just as a boiler feed water pump raises pressure of water in a steam generating cycle. The compressor boosts pressure of incoming air from about 14 pounds per square inch absolute to about 78 psi absolute. In so doing, it absorbs about 13,500 hp of energy from the turbine. (The turbine must generate a total of 20,000 hp in order to deliver 5000.)

Upon leaving the axial flow compressor air pressure drops throughout the rest of the cycle. It passes through the shell side of the regenerator, exchanging heat with the exhaust gases passing through the regenerators 5100 tubes. It enters at a temperature of 476° F. and leaves at 830° F. Then the air flows to combustion chambers.

Several problems were overcome in design of combustion chambers. The first had to deal with metallurgy of the chamber itself, the second was to stabilize flame propagation. The solution was to use the best metal available, forming it into an inexpensive liner which could be replaced every few years.

Because of the high inlet air velocity there was a tendency for the flame to be blown from the chamber. This was overcome by introducing air through swirl ports on the liner, creating a vortex in the chamber. The rotational velocities are higher in the region of the chamber axis than at the liner wall. This causes a reduction in static pressure with gradient toward the nossle outlet. Because of pressure difference, there is a flow reversal into the stagnant region carrying high temperature gases to the incoming fuel, thereby stabilizing combustion.

The temperature of the air is raised to a maximum of 1450° F. inside the chamber. This combustion system can be compared to the application of a blowtorch to a small air stream to heat the air to a higher temperature. Not all of the oxygen present in the air supply is burned. The main reason for the much larger air volume than needed for combustion is to keep the combustion chamber temperature down to a predetermined temperature within the operating range of the

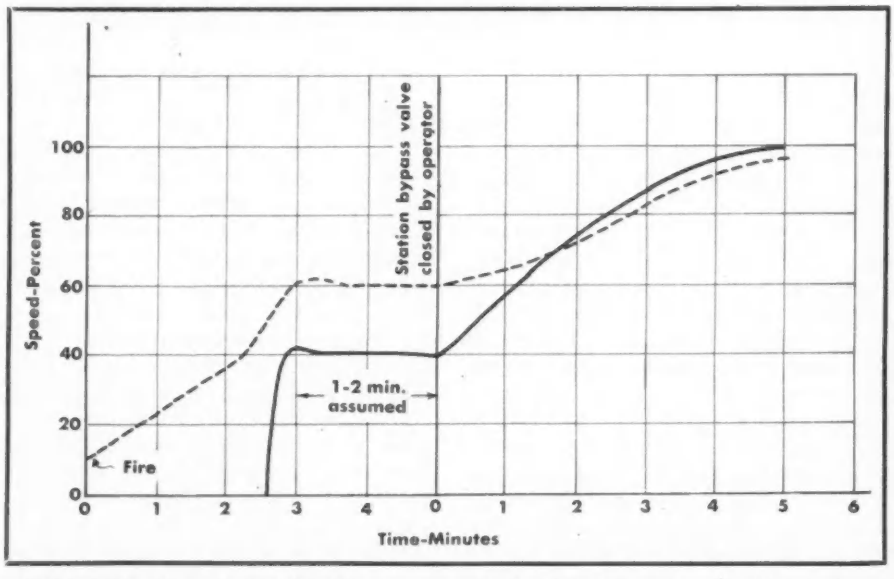


FIGURE 5. Starting period with cold regenerator for load shaft speed and axial compressor shaft speed. Acceleration rate after bypass valve closes depends on how long unit remains at 40 percent load speed. Full speed on load turbine is 85 percent load in case shown.

PIPE LINE PROGRESS

26-inch for Texas Gas Transmission Line

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A. O. Smith's contribution to this great addition to the major gas transmission systems of the nation has been shipment of more than 1,300 miles of 26-inch, 20-inch and 16-inch diameter pipe. They were delivered to meet construction requirements for the main line, looping, extensions and some river crossings.

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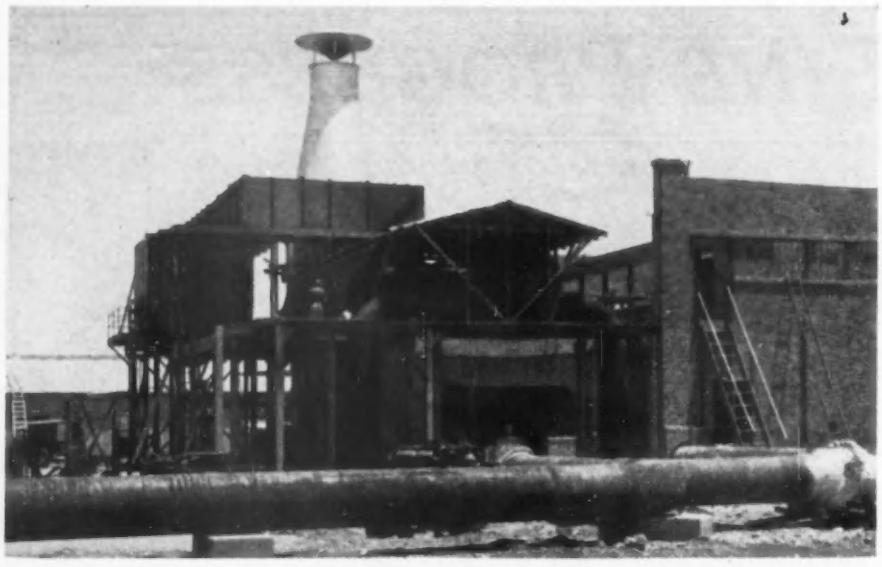
DEPENDABILITY THROUGH RESEARCH AND ENGINEERING



This is a gas turbine compressor station under construction. Stack in background is regenerator, a vertical 5100-tube heat exchanger which increases thermal efficiency of turbine from 17 to 25 percent.

unit. After being heated in the combustion chamber, and dropping about 3 psi pressure, the hot gases pass through the turbine nozzles into the high-pressure turbine wheel. This high-pressure turbine wheel is used to drive the air compressor at a maximum of 6900 rpm.

Immediately after passing through the high-pressure turbine wheel, the hot gas is then deflected into the low-pressure turbine wheel. This low-pressure turbine wheel then drives the centrifugal gas compressor, or any other rotating load device that is adaptable for use with the turbine. The exhaust gases, leaving the low-pressure turbine, are sent to the regenerator at a temperature of approximately 920° F., and this exhaust gas temperature decreases to approximately 577° F. at the outlet of the regenerator.

One of the principle advantages of the use of the gas turbine is its ability to operate with a bare minimum of water. Throughout the route of El Paso Natural Gas Company pipe line, water is a critical item. Fortunately, the turbine itself requires very little cooling; the main cooling load is that of the lubricating oil system. This load can be easily handled by a closed, air-cooled system. The only water that is necessary is that used to cool inlet air during summer time. This will not likely require more than ten gallons per minute per turbine.

Automatic controls make gas turbine stations possible. Speed responsive relays and motor driven relays control the sequence of operations necessary to start-up and shut-down of the turbine station. Figures 4 and 5 show the starting sequence. When the operator turns the master control switch to "start" the sequence relays take over and complete the operations shown in the diagram. The initial span of time shown at the beginning where the seal oil tank fills, etc. will be considerably shortened after initial start up since the seal oil tank will usually be filled and the other operations require little time.

Once the seal oil tank is filled etc., the nozzle dump valve closes. This valve controls the attitude of the nozzles directing expanding gases across the low-pressure turbine buckets. The angle of attack varies over a range of 38 degrees. Whenever the stopping signal is given, this valve turns the nozzles to zero position (which may vary with ambient temperatures) and no more power is applied to the gas compressor.

Following the valve closing 160 psig gas is expanded across the cranking turbine and vented to atmosphere. This 290-hp turbine turns the high-pressure end of the gas turbine at 700 rpm.

At this speed, the turbine is purged for about five minutes, to remove all traces of gas and then it is fired by a spark plug ignition system. The turbine is accelerated up to self sustaining speed of 60 percent and the starting turbine is de-clutched and shut down.

When flame indicators show that the combustion chambers are operating and acceleration is underway, a control valve opens to pressure the gas compressor case, (which is vented at each shutdown.) (See Figure 6) The reason this is necessary is that the 30-inch suction and discharge valves open or close in 25 seconds. It would be a great shock to the compressor case if 600 pounds of gas were to hit it in a matter of seconds.

During operation the turbine speed is controlled by a electro-hydraulic

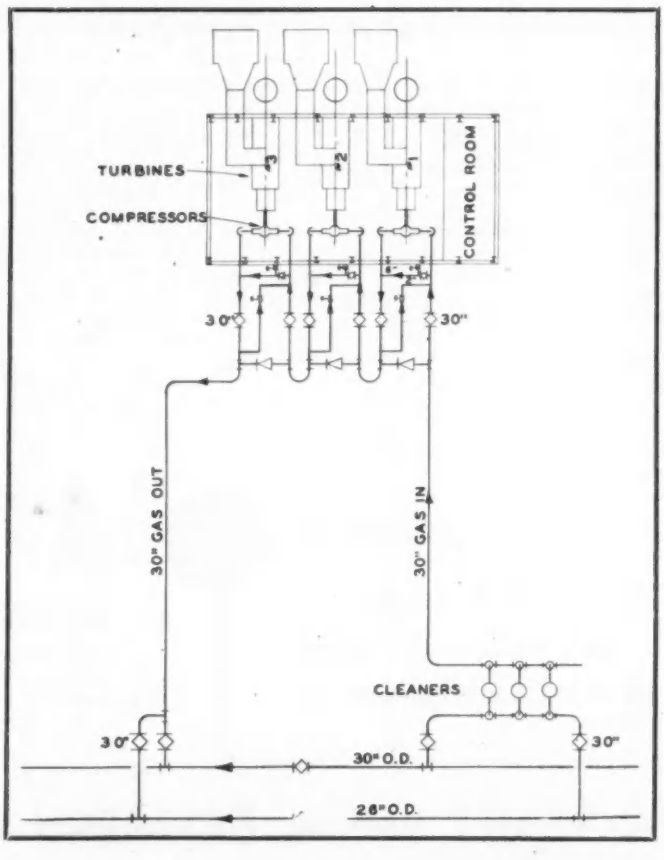
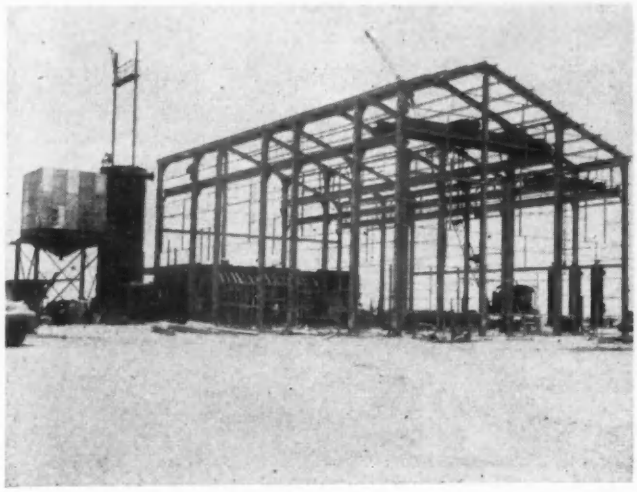
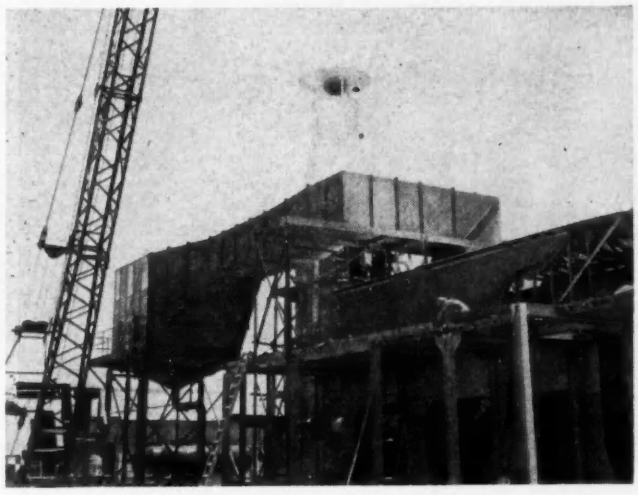


FIGURE 6. Gas flow sheet for centrifugal compressors powered by gas turbine. Control valve on two-inch bypass pressures centrifugal compressor case before each start-up to eliminate shock of 800 psi gas entering case suddenly. When turbine is shut down, the compressor case is vented and seal on bearings revealed.

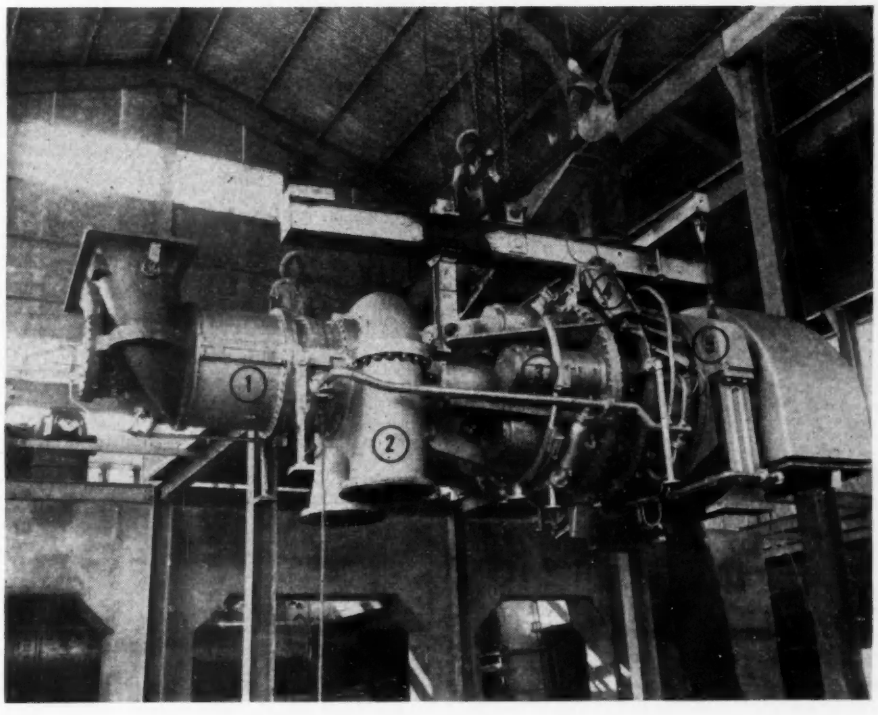


1 Steel for compressor building. Compressor mat is 30 inches thick. Forms at left are for piers which will support turbine and compressors.



2 Station construction progresses. Elevated box-like structure at left is air washer which cools intake air to increase turbine efficiency on hot days as much as 20 percent. Regenerator is in background.

Here's how gas turbine stations are built



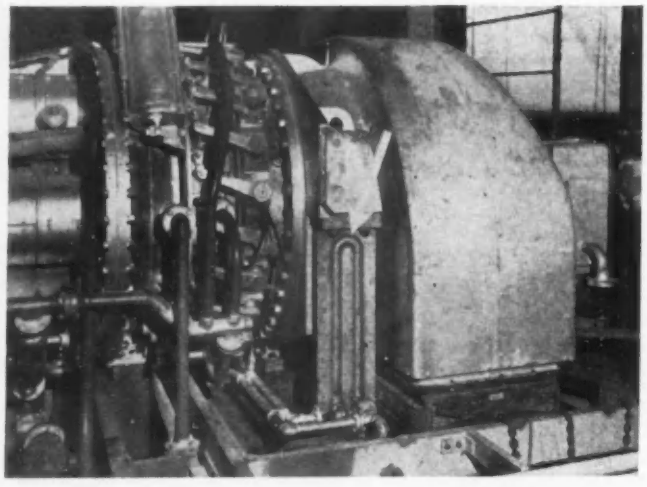
3 Setting the 24-ton 5000 horsepower gas turbine with crane. (1) Axial compressor which takes in 80,000 cubic feet of air per minute, boosts its pressure to 78 psi (absolute). (2) Pressure in turbine is highest at this point: air will be piped to regenerator. (3) Combustion chamber. Gas flame inside heats gas to about 1400 degrees for expansion across first turbine. (4) Hydraulic cylinder adjusts angle of nozzles between high-pressure turbine and low-pressure turbine by means of lever arm. (5) Low-pressure, load turbine beneath the number. This load turbine has independent shaft and usually operates as different speed from axial compressor turbine.

governor. This instrument receives its electrical signal from a tachometer generator connected with the load shaft, and translates this into a control oil pressure which regulates position of fuel oil valve. Excessive exhaust gas temperature exerts an overriding control on the valve.

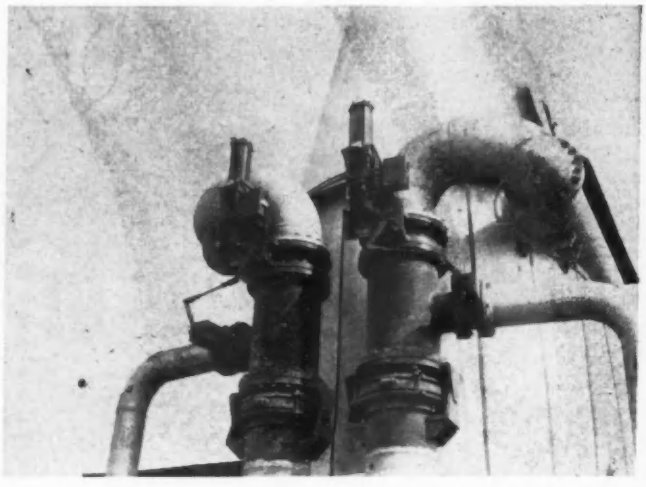
The control can be turned over to a pressure controller on the station discharge which adjusts a rheostat in the governor to maintain a constant gas pressure discharge. This instrument will shut down the turbine if station suction falls below 450, if the station discharge falls below 513 psi and if the station discharge increases above 813 psi.

When the stopping signal is given—either automatically or manually—the fuel is shut off, the generator is by passed, the main suction and discharge valves closed and the fuel nozzles are dumped. The load shaft turbine comes to rest in approximately 6 to 8 minutes and the high-pressure shaft in about 15 minutes. The DC lube oil pumps operate for 30 minutes after the unit comes to rest to keep the bearings cool. A recirculating water system with a 1½ hp pump, a 120-gallon tank and 315-gallon auxiliary tank for heat storage cools the turbine support lugs, the variable nozzle stems and the turbine shell during cool down period.

Since most of El Paso Natural's turbine stations are located in isolated areas, it was necessary to design each one to be self-contained. Each station has three sources of electric power: (1) an AC 75 kw generator, gear driven from high-pressure turbine shaft, (2) a gas-engine-driven AC generator and (3) a 60-cell, 400-

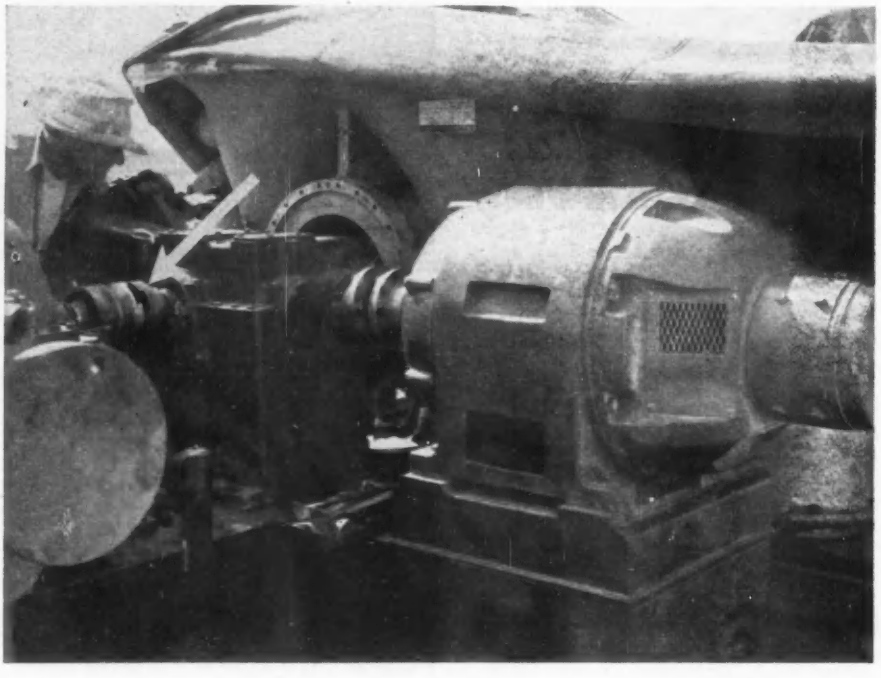


4 Closeup of turbine end. Cylinders at left are combusion chambers. High-pressure turbine which drives axial compressor is beneath the hydraulic cylinder at top. Air foil type nozzles which are operated by linkage in center can vary angle of attack on blades of low-pressure turbine as much as 38 degrees. This permits great economy in fuel. Arrow points to 1¼-inch pipe cut in half and welded to turbine support. Cooling water circulating through it keeps support at constant temperature.

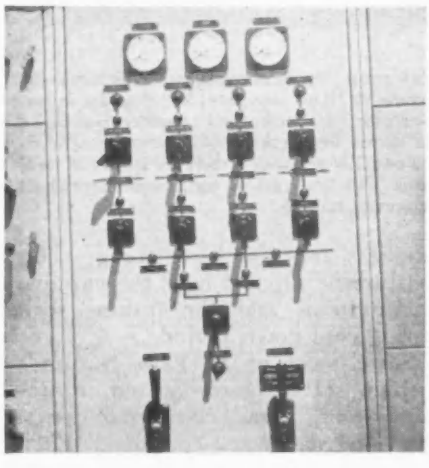


5 Air piping on regenerator. Small piping allows air to bypass during start-up. Ordinarily 476° F. 78 psia air from axial compressor enters shell of this 5100 tube heat-exchanger, passes downward to be heated to 830° F. This regenerator, which weighs 124 tons, increased thermal efficiency from 17 to 25 percent.

6 Men at work on cranking turbine. 160 psig gas enters turbine at (1) and exhausts through (2) to atmosphere. This turbine develops 290 horsepower; it first turns the turbine about 700 rpm for several minutes to purge all gas. At this speed the turbine is fired and accelerated up to 60 percent of its speed. Then the cranking turbine is de-clutched.



7 This 75 KW AC generator helps make the turbine more or less self-sufficient. Arrow points to clutch of cranking turbine also attached to the single power take-off. This generator provides current for lube oil and cooling water pumps.



8 Portion of electrical panel board. Stations have two boards, one for electrical, the other for instruments. A single master switch can set off starting sequence which ends when station goes on line.

ampere-hour-station storage battery.

The battery provides an eight-hour supply of DC power for the main turbine control and supervisory circuits, emergency lighting and essential auxiliaries such as emergency nozzle cooling water pumps, emergency lube oil in case the turbine driven generator fails and the gas-engine-driven generator is shut down.

Under normal operating conditions, the turbine driven generators supply all of the power necessary for turbine auxiliaries, and normal starting can be accomplished without any external source of AC power. Since the speed of this generator varies as speed of the turbine shaft, the frequency varies from 36 to 60 cycles. In as much as voltage varies as the square of the speed on a self excited machine, it was necessary to install a volts-per-cycle regulator. This prevents overheating of squirrel cage induction motors.

El Paso Natural is winding up construction of a number of the gas turbine stations this month. After short trial runs they will go on the line to increase deliveries of natural gas to California. The company expects many new operating problems to arise because the design of the stations is a departure from that of conventional stations.

Thirtieth Anniversary

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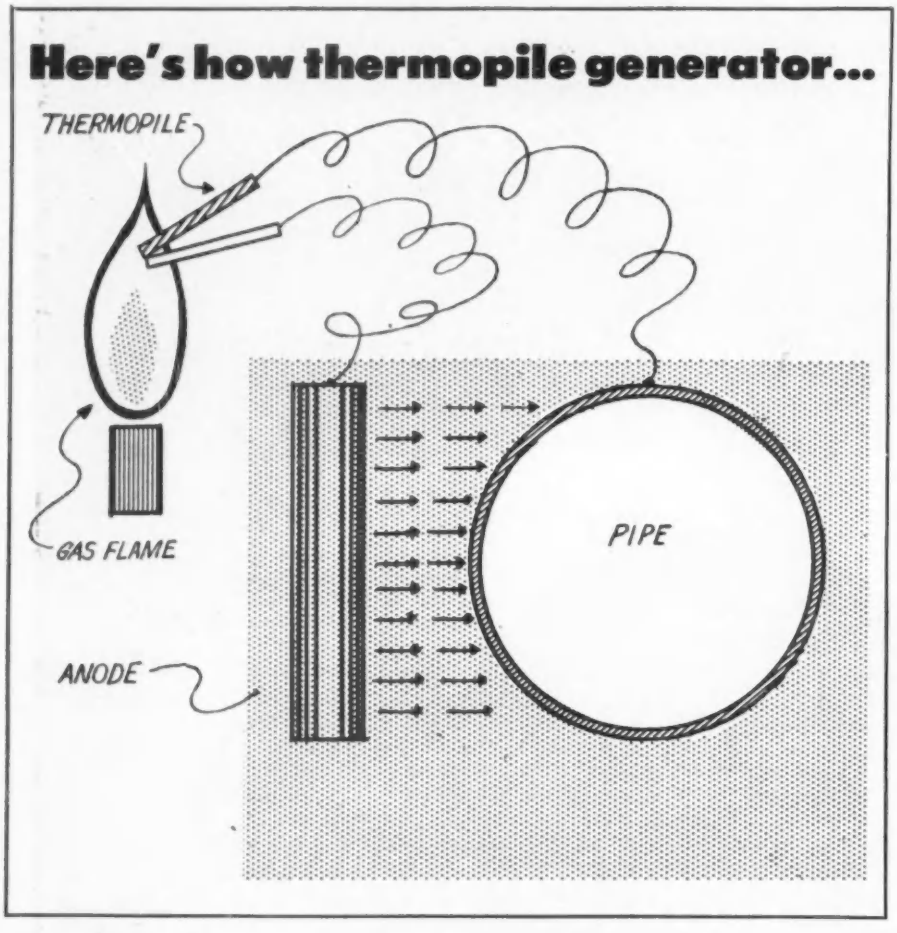


Produces Electricity From a Gas Flame

And El Paso Natural Gas Company is using this method to protect pipe line from corrosion.

By R. J. EMERSON
Corrosion Engineer, El Paso Natural Gas Company

ELECTRICITY produced by gas-fired thermopile generators has been providing corrosion protection for two years at three remote points on El Paso Natural Gas Company's pipe line system.

These units have no moving parts and consequently require little or no maintenance. They generate current directly from the heat of a flame. Banks of series-connected thermocouples are gas-flame heated at hot junctions to produce direct current.

Although still in experimental stages, the three generators on El Paso Natural's system have been producing 30 to 40 watts each, to protect lines passing through areas of high soil resistivity where the use of sacrificial anodes would be questionable. Two of the units are installed in western Arizona on the 5½-inch Yuma branch line. The other is tied to a 12¾-inch line about 20 miles from Carlsbad, N. M. In each instance there was no economical source of AC power.

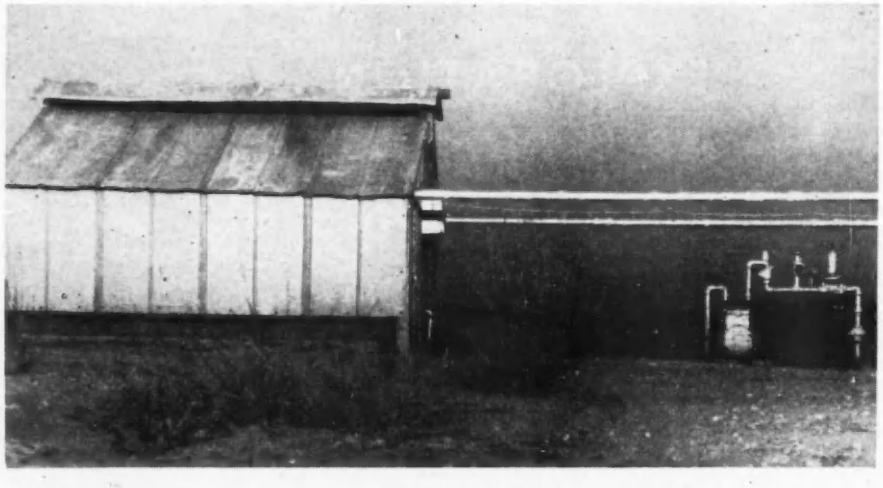
When maintenance is considered, these units have afforded remarkable economies. For example, two of the units have given more than a year's trouble-free service without attention of maintenance men.

Yet, the units have limitations. As a source of power, they are not thermally efficient. Gas-engine-driven generators produce much more power on an equal amount of fuel. In fact, where large amounts of current are required for protection, the use of engine-driven generators may be advisable—despite increased maintenance costs. Primarily, the thermopile generators are applicable to well coated pipe lines which require small amounts of current; where high soil resistivity rules out use of sacrificial anodes and where off and on output of wind-driven generators is undesirable.

How It Works

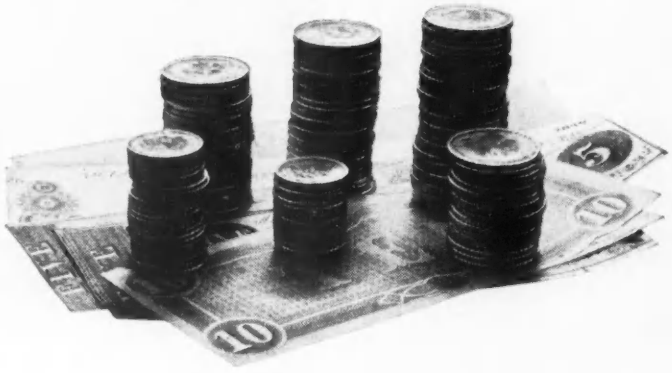
The operating principle has long been used in measuring temperature. When the ends of two pieces of dissimilar metals are bonded together and heated, a difference of potential appears between their free ends. Such a combination is called a thermocouple. The thermoelectric currents are due to molecular agitation at the heated junction.

The electrical reaction to heat of suitable metal couples follows exact



Thermopile generator installation on 13¾-inch Eunice to Carlsbad, N. M., pipe line. This generator is in an isolated spot and seldom visited by maintenance men. Three such installations have been giving El Paso Natural Gas Company almost trouble-free service.

Bell System communications save you



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------maintenance

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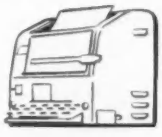
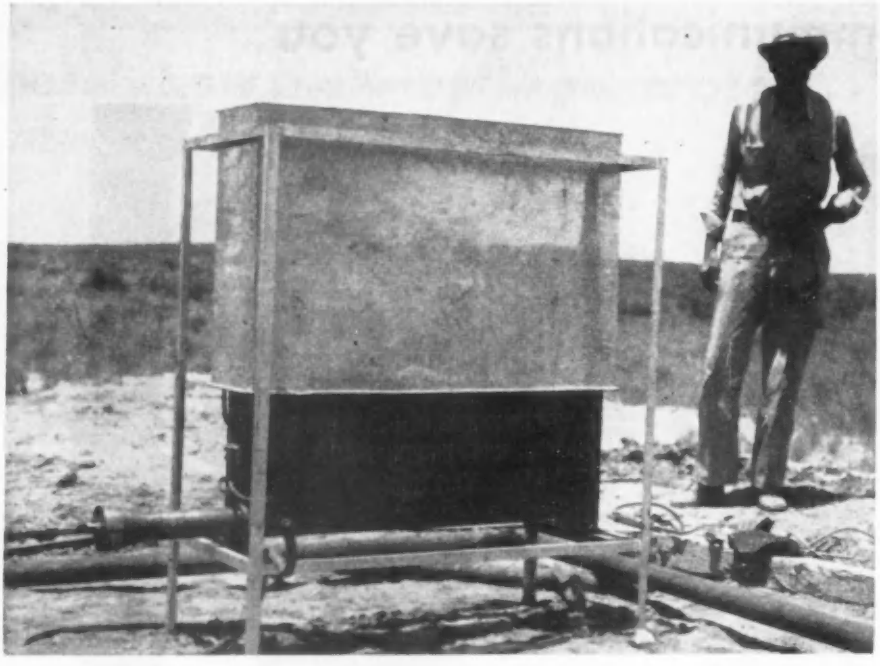


TELETYPEWRITER

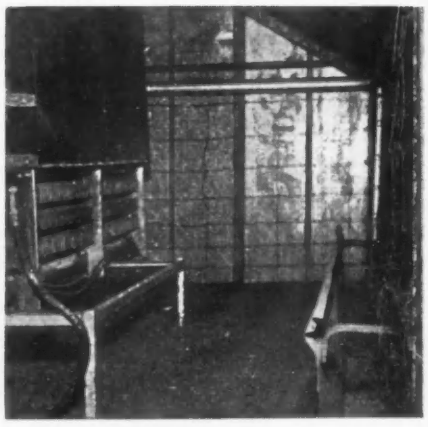
MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM



Here's a thermopile generator before housing was installed. Rectangular stack at top creates draft of furnace line generator.



Interior of generator housing with thermocouples connected in series. Hot junctions of couples are inside generator where hundreds of small flames heat them to produce current. Baffles at right prevent wind from blowing out flame inside generator. Ventilation is necessary because thermopile output is function of the temperature differential between hot and cold junctions.

patterns—the hotter the junction the higher the potential.

As applied to temperature measurement thermocouples can be made up of several combinations of metal wires such as iron and constantan or chromel and alumel. With the junction located at the point of temperature measurement and the free ends brought out to a position of lower temperature, the small electric potential as measured on a galvanometer, or potentiometer will indicate the temperature.

By joining many thermocouples in a series the output can be greatly increased as each couple helps the other. Heat is applied to the tips of the junctions on one side only. Such an arrangement is called a thermopile.

In the case of the commercial thermopile generators the size is greatly enlarged. Two-inch wide bands of metal make up the couple instead of wires. The unit is approximately four feet long, two feet high and one foot wide. Couples are arranged in four sets of horizontal banks. Two sets are on one side and two sets on the other with vertical burner tubes in between. Holes are arranged in these tubes so that the flame tips meet the adjacent junction tips. The tubes are supplied with a gas air mixture from a horizontal pipe along the bottom. At one end of the pipe is the mixing chamber and fuel supply.

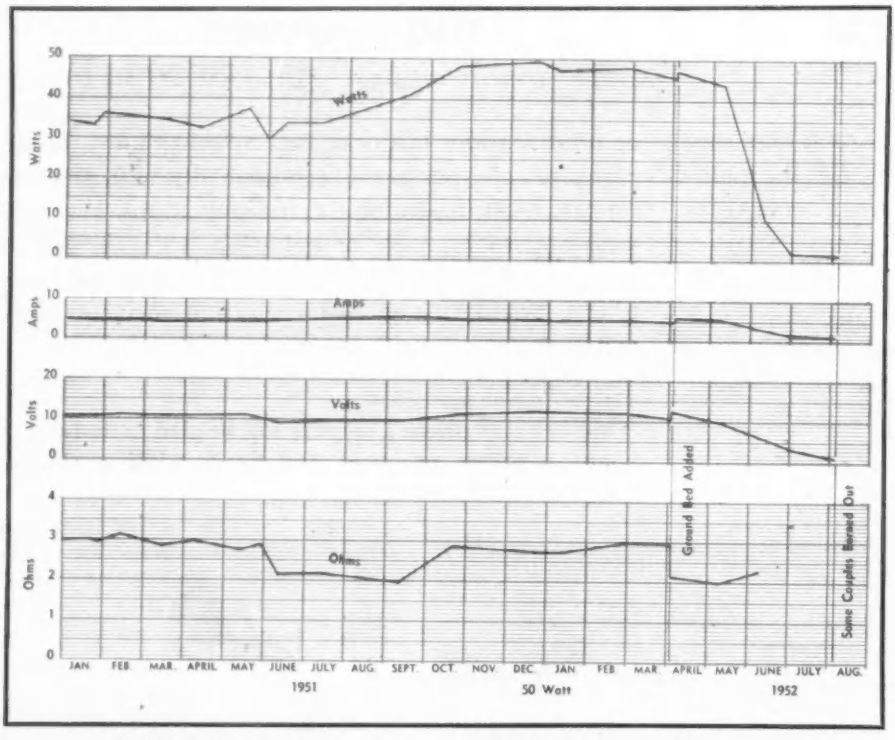


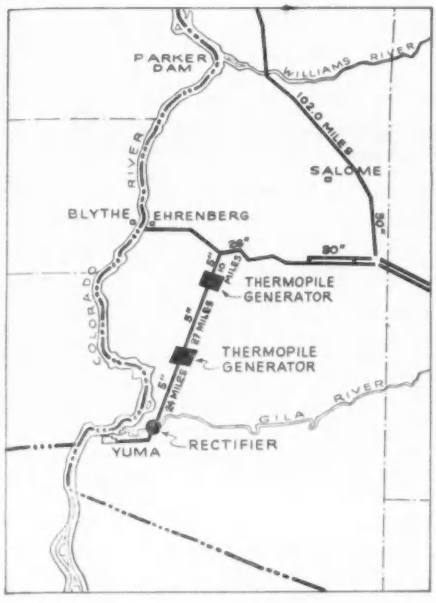
FIGURE 1. Performance curves for one thermo generator on Yuma line.

Arranged in Banks

The couples are arranged in four sets of banks so that different volt-amp combinations may be obtained to meet the various ground bed resistances. Though the couples of each set of banks are in series the four sets themselves may be connected in parallel, series parallel, and in series. However, as with any source of DC current for cathodic protection, the ground bed resistance should be made as low as economically feasible to provide a high amp-to-volt ratio.

El Paso Natural Gas operated the first unit experimentally for a few months before installing it on the pipe line in June 1949. The first problem to be overcome was that of housing for the unit. A shelter had to be provided which would provide ventilation and cooling, yet which would keep strong winds from blowing out the gas flames inside the unit.

After a number of shelters had been designed by means of trial and error, a simple rectangular shaped house with baffled openings along the



Map shows location of two thermopile generators and rectifier in western Arizona on Yuma pipe line.

About the Author

R. J. EMERSON was graduated from Texas College of Mines in 1941 with a degree in Mining Engineering. He did advanced study in metallurgy and then joined Youngstown Sheet and Tube Company. He joined El Paso Natural Gas in 1946 and is now a corrosion engineer.

sides at bottom, proved successful. The baffles allow plenty of ventilating air to enter the structure, to cool the cold junction of the thermocouples and to provide air for combustion. A shielded opening at the top of the house allows heat to escape.

The first unit generated from 25 to 40 watts for 14 months until a few of the couples burned in two. They were bypassed with a bond and the unit continued to operate for seven more months at a somewhat reduced output. At the end of this period more couples were oxidized and the unit was removed from service.

In May of 1951 the manufacturer provided a much improved model which incorporated features to allow for expansion and easy replacement of the thermopiles. The original design of two large sets of banks was changed to four smaller sets as previously described. The unit is still operating.

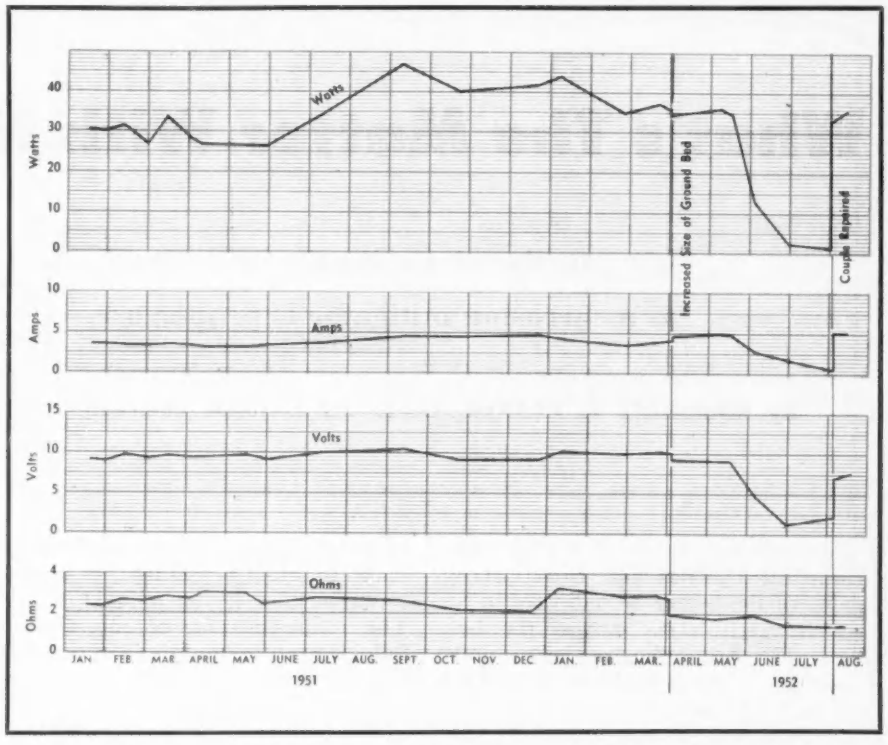


FIGURE 2. Performance curves for second thermo generator on Yuma line.

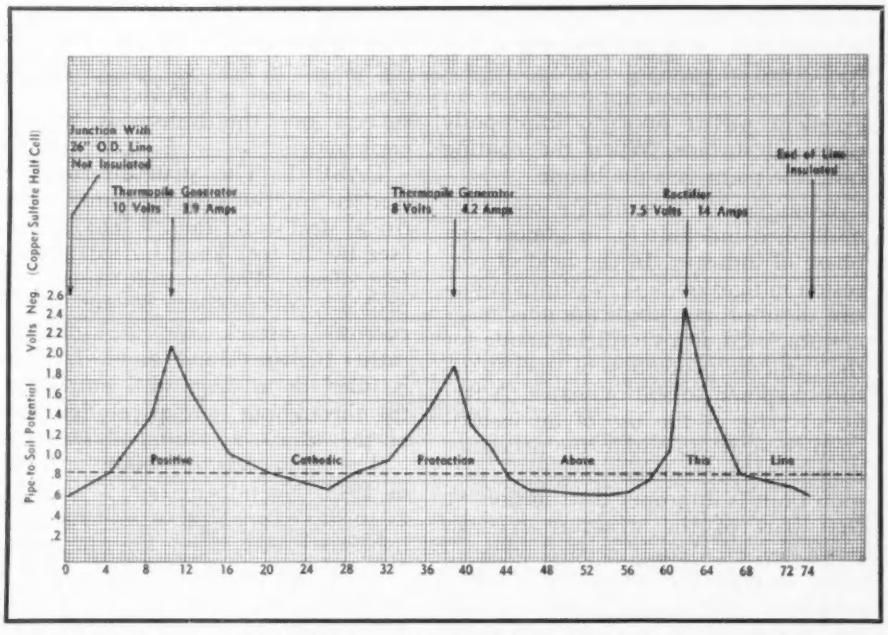


FIGURE 3. Mile-by-mile plot of cathodic protection on Yuma pipe line furnished by two thermopile generators and one rectifier.

In December, 1950, and January, 1951, two units were installed on the Yuma Line. Figures 1 and 2 show their performance. It will be noted that the output of both fell off around April and May, 1952. Examination revealed a portion of the banks of the unit in Figure 1 to be burned out to the extent they will have to be replaced. The unit in Figure 2 required only minor repairs to restore it to its former output.

Figure 3 shows the extent of cathodic protection afforded on the Yuma line by two thermopiles and a rectifier. The shorter range of the rectifier is due to lower soil resistivity in that area and possibly more defective coating on the pipe.

Although these thermopiles and their housing can still be improved upon they are providing relatively trouble-free cathodic protection in remote areas.

What's The Matter With Magnesium?

It's usually misapplication. Secret of success as a corrosion mitigator is proper use.

By **MARSHALL E. PARKER**, Consulting Corrosion Engineer, Houston

REMEMBER the Mad Hatter, who complained about the lubricating value of the butter he had used in his watch, although "it was the best butter?" Misapplication of a good material—although seldom as extreme as the Hatter's case—usually leads to condemnation of the material. Misapplication may consist of using a product for a use to which it is not suited, or even, more commonly, using it incorrectly for a purpose to which it is adapted. An example of the latter is the all-too-common application of an excellent paint over an improperly prepared surface. When the coating fails, the paint gets the blame.

Examples of this nature could be multiplied indefinitely, in almost any phase of industry. In the field of corrosion mitigation, a very common victim of improper application is magnesium, used as a sacrificial anode for the cathodic protection of steel structures exposed to soil or water. A frequent error is the use of an insufficient quantity to obtain the necessary degree of protection. Another common fault is improper distribution, so that part of the structure receives more current than is needed while in other sections the protection is below standard. Still a third mistake is failure to control the current output, so that all of the structure is over-protected, but for a length of time less than that anticipated. There is also the error of attempting protection by the use of magnesium in a situation where it is either totally inapplicable, or much less suited than some other source of cathodic current.

Basically, all errors in application of magnesium are failures to take into account all relevant factors. It is very easy to make these errors of omission if one has not had an extensive experience with corrosion problems, with cathodic protection, and with magnesium in particular. They are the kind of errors that a good cook might make in mixing concrete, or a good concrete man trying to bake a cake. The misapplication of the material follows from the misapplication of the human knowledge and ability involved.

Case Histories

Two cases involving the use of magnesium anodes will be described; one of these was an economic success, the other a failure. Neither the success nor the failure is hard to explain.

CASE 1. The structure involved was the interior of a horizontal cylindrical steel water tank, 4 feet in diameter by 22 feet long, buried about 3 feet deep. The outside surface is probably not subject to any serious corrosive attack, for the soil is a rather high-resistance sand. The tank is filled by a deep well pump, and the throughput is relatively low most of the time.

The tank was originally installed in 1941. No information is available as to the exact type of internal coating, but it was "some kind of paint." In 1944 the pressure indicated a leak or leaks, and the tank was drained and inspected. Deep pitting, with several perforations, was found irregularly distributed along the bottom of the tank, the attack obviously coming from the inside. At this time the tank was dried and sandblasted, and a brush coat of red lead primer and engine enamel was applied.

The next difficulty encountered was clogging of valves and strainers with the enamel, which was clearly blistering off rapidly. Eight months after the paint job, new leaks appeared, and more welding was required. The remainder of the loose paint was removed, and no attempt at coating was made.

This repair was good for only six months, when leaks again made their presence known. The same type of repair was made, and another six months of satisfactory operation followed. Prior to the anticipated shutdown, however, plans were made for remedial measures. Three possibilities were considered; a really adequate coating, cathodic protection, and a combination. It was found that a good plastic coating could be applied for $375—including drying, sandblasting, and all—but not including the necessary welding. This amount is represented by an actual bid received for the work.

The wetted area of the tank is approximately 250 square feet. At 2 milliamperes per square foot, a total current of 500 mils would thus be required. How many anodes are required to supply 500 mils? Here is the first good chance to go astray. The current output of an anode is determined by several factors; the resistivity of the electrolyte (most important); the resistance of the connections, which is not a factor unless resistance is deliberately introduced to limit the output; the geometry of the installation, which means that an anode close to a surface will in general put out more current than if it were further away; and the potential of the protected surface.

The resistivity of water can be determined with reasonable accuracy from the total dissolved solids content; this particular water had a total of about 800 parts per million, indicating a resistivity in the neighborhood of 600 ohm-cm. In such water, a 16-pound anode may be expected to deliver approximately 120 milliamperes when operating against a steel cathode which is at protected potential. The diameter of the tank is such that the proximity effect could be expected to increase this

■ CONTINUED ON PAGE 318

Produce oil wells directly into pipelines? This practice would save the industry millions of dollars. And a step in this direction . . .

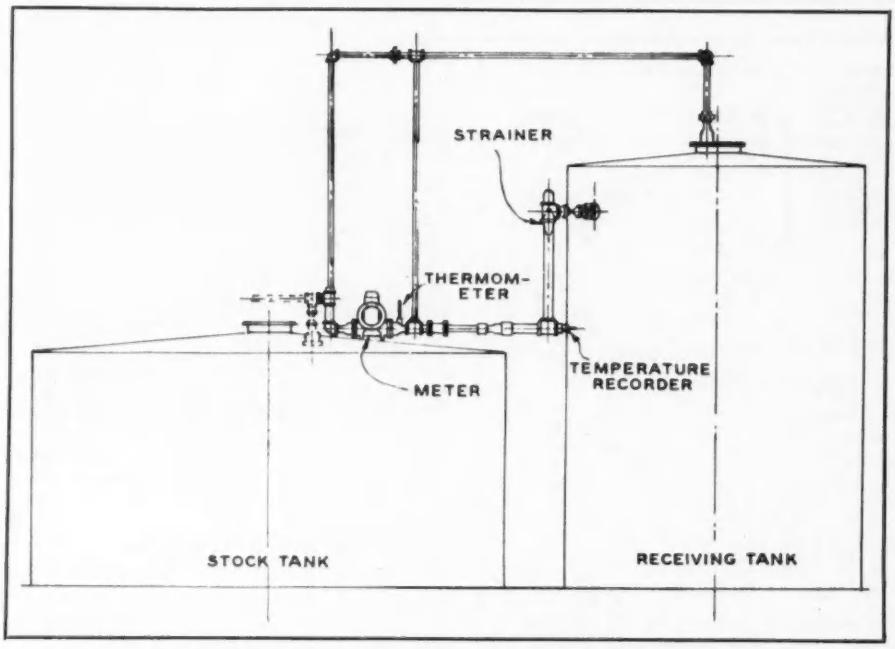


FIGURE 1. Meter installation. Stock-tank oil measurement.

Tests Show Accuracy of Crude Oil Meters

By F. J. DAASCH
Mechanical Engineer, Tulsa

How ACCURATE are crude oil meters? To what extent do entrained gas, sand and paraffin affect measurement? How can these effects be minimized? What is the best type meter? These are some of the questions that motivated a major oil company in the Mid-Continent area to conduct the tests described in this article.

It has long been recognized that accurate and dependable crude oil meters could minimize lease tankage, cost of gauging and field maintenance. These tests which lasted more than one year are a stride forward in more efficient producing and pipelining.

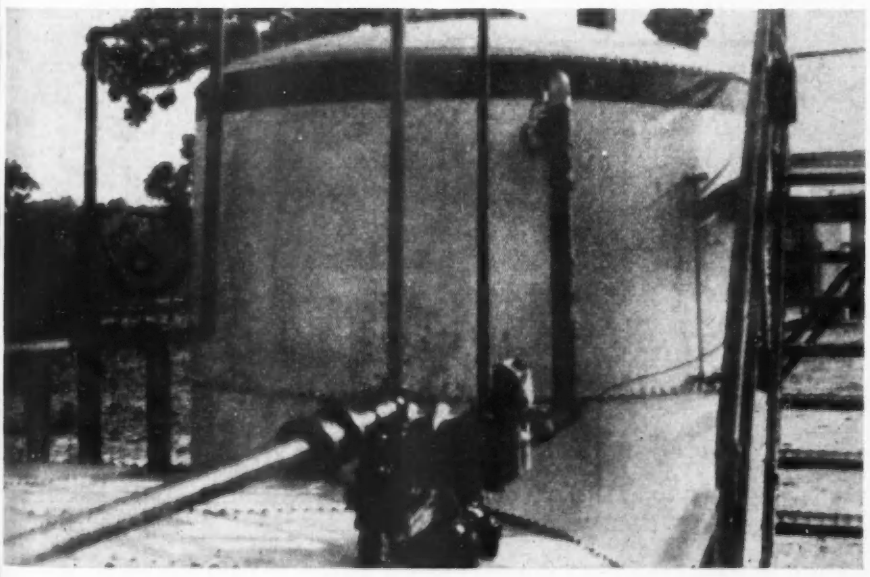


FIGURE 2. Oil meter installation between receiving and stock tanks.

Figure 1 shows the piping layout for the measurement of production into stock tanks. Since a comparison was to be made between meter readings and tank gauges, the temperature variation between the oil as metered and that gauged in the stock tank was also investigated. In order that any entrained gas would be released, if possible, risers or vent lines were placed immediately upstream and downstream from the meter. The meter was so situated that it was maintained full of liquid at all times. This sealed the mechanism against the measurement of free gas as well as its corrosive action. Figure 2 is a view of this type of setup.

For the 71 days of continuous operation before failure of the meter occurred, there was a cumulative difference of 0.28 percent, or therefore 0.28 barrel per 100 barrels, between the meter reading and tank gauges. This difference was computed from

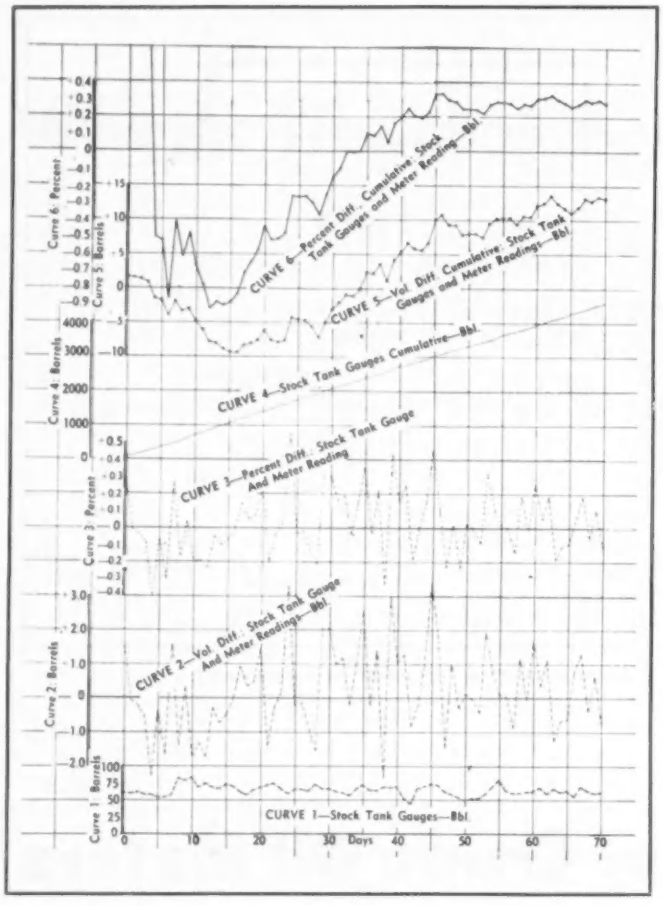

Curve 6: Percent
Curve 5: Barrels
CURVE 6—Percent Diff., Cumulative Stock Tank Gauges and Meter Readings—Bbl.
CURVE 5—Vol. Diff. Cumulative Stock Tank Gauges and Meter Readings—Bbl.
Curve 4: Barrels
CURVE 4—Stock Tank Gauges Cumulative—Bbl.
Curve 3: Percent
CURVE 3—Percent Diff., Stock Tank Gauge And Meter Reading
Curve 2: Barrels
CURVE 2—Vol. Diff. Stock Tank Gauge And Meter Readings—Bbl.
Curve 1: Barrels
CURVE 1—Stock Tank Gauges—Bbl.
Days

FIGURE 3. Comparison of oil volumes. Stock tank gauge and meter reading.

volumes corrected to 60° F.; however, daily volumes "as read" indicated only minor and inconsequential changes, as compared to volumes corrected to standard temperature. Curve 6 of Figure 3 graphically charts the cumulative percent difference throughout the test. The remainder of the curves of Figure 3 present the other essential quantities.

It should be noted in Curve 3 that the daily percent difference was reasonable throughout the period. As it fluctuated in both the plus and minus sense, it is indicative that the stock-tank gauging practices are inaccurate or at least are not consistent in the magnitude of error. This difference prevailed although stock-tank gauges were made with unusual care and within closer limits than customarily taken. The meter reading was recorded to the nearest 0.1 barrel. In connection with this type of meter application, it should be recognized that although the daily stock-tank gauge, Curves 1 and 4, was essentially constant, the rate of flow varied considerably. During the dumping of the separator fluid into the receiving tank, the rate of metering increased and then finally diminished to an insignificant amount. Needless to mention, such a variable rate is not conducive to a uniform percent of meter error. A more detailed study of the curves (Figure 3), offers much on crude oil measurements. A value is considered plus when a meter reading is greater than tank gauge.

Although the above method of oil measurement was investigated, it is evident that with the present arrangement of many lease tank batteries, the most suitable location for the metering of oil is at the pipe line outlet of the stock tanks. This position has definite advantages, primarily in that the oil has time for settling and therefore contains a minimum of gas and foreign matter.

In an original installation of this nature, a meter was so installed in a by pass that all oil pumped from the lease stock tanks was metered, but if it was desired, the regular line could be placed in service immediately. The meter was installed in a loop so that it was flooded at all times. A strainer fitted with an eight-mesh screen was placed upstream from the meter. A system of vent lines was erected on the upstream and downstream sides of the meter setting. This served to eliminate the accumulation of gas. It also permitted the pipe line pump, located further downstream, to operate for an indefinite period, dependent upon pumper convenience, even though the tank oil had been run. The vent lines were manifolded into the gas space of the stock tanks, and a valve placed at each tank as a precautionary measure. This made possible a closed system with any tank of oil being run. As difficulty was experienced with oil surging through the vents each time the system was placed in service, it was necessary to equip the vent lines with surge tanks.

This type of installation operated satisfactorily for approximately three months with a cumulative difference of 0.29 percent between the pipe line gauges and meter readings. However, the increased friction of the meter mechanism at that time made it desirable at the end of five months to alter the arrangement in order to im-

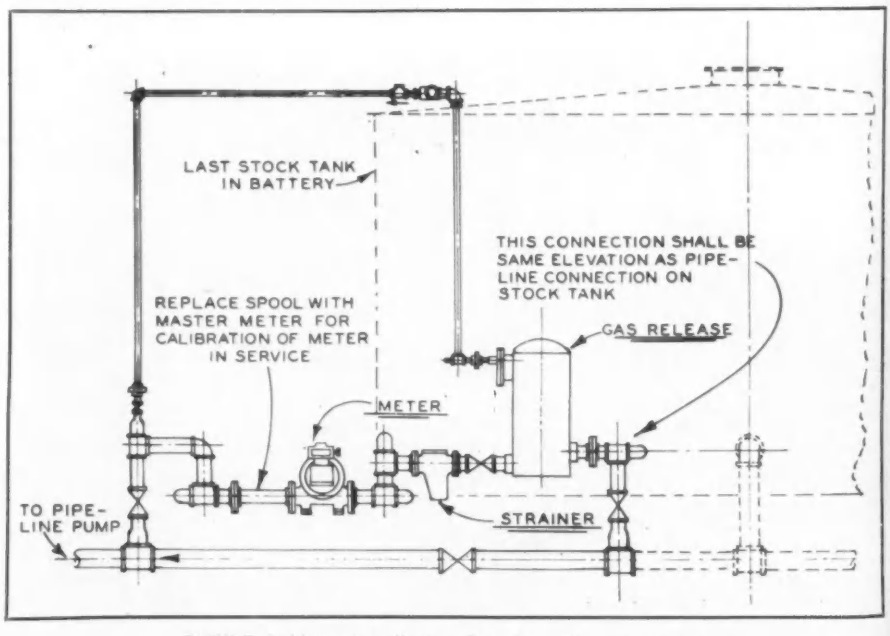

LAST STOCK TANK IN BATTERY
THIS CONNECTION SHALL BE SAME ELEVATION AS PIPE-LINE CONNECTION ON STOCK TANK
REPLACE SPOOL WITH MASTER METER FOR CALIBRATION OF METER IN SERVICE
GAS RELEASE
METER
TO PIPE-LINE PUMP
STRAINER

FIGURE 4. Meter installation. Pipe line oil measurement.

prove the service. This work suspended the test for approximately 60 days.

Figure 4 is a general piping layout which depicts the present arrangement of the experimental equipment. It should be noticed that the metering equipment continues to be located on the suction side of the lease pipe line pump. This is always the least expensive in initial cost and is believed to materially prolong the life of the meter as compared to its use on the discharge side where very high pressures and high-pressure surges may be encountered.

The gas release accumulates any gas and maintains a fluid seal on the meter so that the static and suction heads can be impressed upon the oil being metered. As the tank oil is withdrawn to shut-off level, the vent valve of the gas release opens and the gas which is withdrawn is not metered. The control of such a set up is, of course, automatic, positive and requires no manual attention for an indefinite period by the producing agent. In fact, these features are the primary aims to be accomplished. Figure 5 is a pictorial view of the arrangement.

Figure 6 graphically expreses the data taken over a period of one year. It is indicated by Curve 3 that the daily percent difference between pipe line gauges and meter readings is

FIGURE 5. Meter installation for pipe line measurement.

very satisfactory throughout the period of test. During the test period shown there was a cumulative difference of 0.18 percent (Curve 6). A value is considered plus when the meter reading is greater than pipe line gauge. After the initial three months period, the meter was disassembled, cleaned and inspected. The resulting change in the operating characteristics of the meter is emphasized by Curves 5 and 6, which show an ascending trend in the early period, followed by a higher slip and therefore a descending trend during the remaining period of test. Regardless of the type of crude oil, it is believed that a meter should be flushed at regular intervals for best service, about once each month while in place. This can be easily accomplished if proper arrangements are made and is believed to do much to prolong meter life and improve performance.

In the application of a meter, it is absolutely essential that a suitable filter, strainer or sedimentation tank be used. The very nature of crude oil, however, makes it evident that a filter or strainer which will remove the bulk of foreign matter will also clog and give operational problems. Accordingly, it is deemed advisable to remove only the larger particles with a filter or strainer. In fact, in many cases it is unnecessary to have a high degree of particle removal, as many particles will no doubt be carried satisfactorily by the stream. If the metered oil is withdrawn from a receiving or stock tank, as previously described, this tank becomes in effect an excellent settling tank.

If the best meter results are to be obtained, facilities for meter calibration or proving must be available. Calibration can be made on a basis of volume, weight, or by means of a master meter. The proper equipment and recommended procedure for calibration with volatile liquid petroleum products are quite detailed in order to avoid errors due to evaporation, temperature change and entrainment of gases. A complete description of this

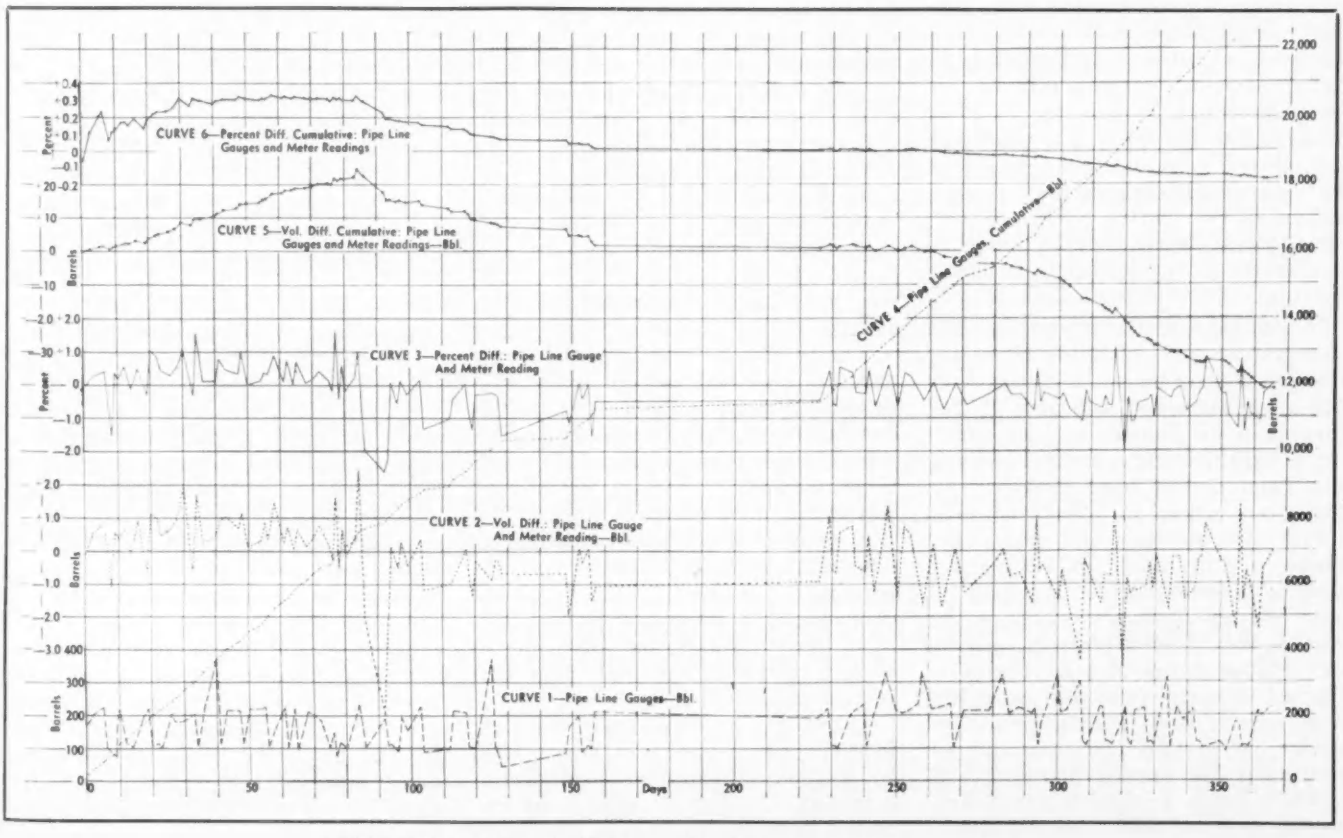

CURVE 6—Percent Diff. Cumulative: Pipe Line Gauges and Meter Readings
CURVE 5—Vol. Diff. Cumulative: Pipe Line Gauges and Meter Readings—Bbl.
CURVE 4—Pipe Line Gauges, Cumulative—Bbl.
CURVE 3—Percent Diff.: Pipe Line Gauge And Meter Reading
CURVE 2—Vol. Diff.: Pipe Line Gauge And Meter Reading—Bbl.
CURVE 1—Pipe Line Gauges—Bbl.
Percent
Barrels
Days

FIGURE 6. Comparison of oil volumes. Pipe line gauge and meter reading.

work is offered in the ASME-API Tentative Code No. 1101. No standard code of practice or procedure for crude oil is available at this time.

Although the subject of well test units is not within the scope of this article, this type of application merits brief mention, as an important field of usefulness for the oil meter would be in connection with complete units for well test work. A recent development of this equipment is the automatic sampler. It is actuated by the meter-counter mechanism and removes a small quantity of the metered liquid from the stream. All the metered fluid enters the sampler but only a proportional sample is withdrawn into a suitable container. The quantity removed is so regulated that the capacity of the container will not be exceeded during the time interval of the test. The relative amounts of water and oil are determined from the sample collected, and the total amount of well fluid is obtained from the meter reading. In addition to the meter and sampler device, units for well test purposes are ordinarily furnished with a gas trap or separator, orifice fitting and meter. The unit may be skid-mounted, trailer-mounted, or permanently installed, dependent upon requirements.

Another recent development, which may be of interest as a potential item for well test service is an electronic device. It is understood that the basic unit of the equipment has been applied to numerous applications for the measurement and control of water. It consists essentially of an electrode which is sensitive to low-voltage electrical fields. The electrode is combined with suitable controls so that a cumulative record of the volume of cut can be obtained. The arrangement necessitates the inclusion of a meter in the set up to measure the total volume of liquid handled.

In looking into the future and the economic features of crude oil measurement control by use of meters, several advantages are indicated. A reduction in the amount of lease tankage is possible. Future developments may even permit lease tank-battery operations where oil could be produced directly into the pipe line. There is still much to be accomplished, however, before this will be fully realized. Another benefit is the possible reduction of labor in gauging and related duties at lease batteries. The use of gauge poles and tapes has been proven over a long period of service, yet certain variations and inaccuracies are known to exist. The problem poses a challenge to engineering skill to fulfill crude oil metering needs in measuring operations.

What's the Matter With Magnesium?

■ CONTINUED FROM PAGE 314

value somewhat—probably to about 140 or 150 milliamperes. Since the total rating of a 16-pound anode, operating at an assumed 50 percent current efficiency, is 900 milliampere-years, it may be seen that the anticipated life should be between six and 7½ years. Since a total current of 500 milliamperes is required, four such anodes were specified.

The total cost of this installation was estimated at $125, again exclusive of necessary repairs to the tank. Since this was only one-third the cost of coating, it was decided to leave the tank bare and depend upon the magnesium alone for protection. Accordingly, in April, 1946, four anodes were installed. They were suspended from angle clips welded to the top center of the tank, being hung so as to reach within 12 inches of the bottom. The four were spaced six feet apart, so that the two end anodes, being only two feet from the ends, would supply current for these surfaces also. No resistors were installed, and no leads brought out by which measurements of either current or potential could be made. Consequently, when the tank was put back into operation, there was nothing to do but wait for developments.

Four-Year Wait

Four years of waiting produced no developments. In view of the six-month intervals between leaks prior to this installation, it was obvious that protection was being afforded, but the degree of protection could not be ascertained. Because four years is an appreciable fraction of the estimated six-year life of the anodes, it was decided to open up the tank and inspect it. This was done in September, 1950, after a lapse of nearly 4½ years.

The results of the inspection can only be described as completely successful. Not the slightest trace of corrosion was visible below the water line. In the air space above the vent, there was some rusting, but a projected life of 40 years for this portion of the tank seems entirely reasonable. The wastage of the anodes was approximately one-half, so a total life of about eight years appears probable. The longer life is possibly due to higher cathodic potential than had been anticipated.

CASE 2. The structure in this case involved the exposure of about 1000 square feet of bare steel to salt water, probably somewhat more concentrated than sea water. The first leaks had been experienced after 18 months of exposure, and several others followed within the next few months. It was decided to protect the structure with magnesium anodes.

One thousand square feet, at two milliamperes per square foot, means a total current of two amperes. It was decided that this would be supplied by twenty 17-pound anodes, each operating at its rated current output of 100 milliamperes. No steps were taken to regulate the output, and no measurements were made of the actual output obtained. Nor were any estimates made, based on the resistivity of the medium. The 20 anodes were installed, and the structure left to their care.

No four-year period was needed for developments. The first new leak occurred just 19 months after the installation. After two others had appeared in a few weeks, the installation was inspected. All of the anodes were completely consumed (their life was probably about 16 months). Corrosion was quite active all over the structure, just as it had been prior to the installation. The conclusion was drawn that magnesium is overrated, that it is undependable as a means of cathodic protection—if indeed, cathodic protection itself is really effective!

Now, of course, this conclusion is wrong. There was nothing wrong with the magnesium on this project. But something was wrong—the way the material was applied.

Actually, this structure was greatly over-protected for a few months. The same quantity of magnesium could have protected it for a much longer period of time—perhaps for the entire expected ten years. A better all-around installation, however, would have resulted from the use of ten anodes, with the output of each regulated by a resistor to a value of around 200 milliamperes. This should have given adequate protection for a period of five years, and could have been replaced at the expiration of that time, with everybody concerned completely satisfied with its performance.

It is easier to misapply magnesium than most materials, largely because none of the phenomena are visible to the eye—the potential obtained, indicative of the degree of protection; the current output per anode, indicative of the expected life—all these are concealed quantities, visible only to the specialized "eyes" of the corrosion engineer's instruments, and, in many cases, requiring the experience of the corrosion engineer to interpret them.

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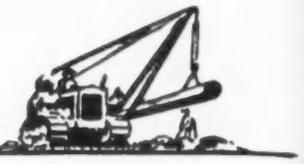
PIPE LINE *Construction*



By ALICE L. GIVEN, WORLD OIL Staff

Projects Announced and Contracts Awarded

Crude Lines

Canadian Gulf Pipe Line Company has assigned contract to Anderson International Contractors, Ltd., Edmonton, Alberta, to lay 67 miles of 12-inch pipe from the Stettler area to Edmonton, via New Norway.

Gulf Refining Company plans to build 22 miles of ten-inch pipe from Wortham, Texas to Corsicana. Anderson Bros. Corporation, Houston, has been contracted to build 80 miles of 24-inch line from Colorado City to Midland, Texas.

Interstate Oil Pipe Line Company has announced plans to build 15 miles of 18-inch line from a connection with a major Texas-Louisiana transmission system, to a junction with Interstate's Shreveport-Baton Rouge trunk line near Shreveport. A further 137.6 miles of 22-inch pipe between Shreveport and Baton Rouge would replace sections of multiple eight-inch and dual 12-inch lines now in operation. The project which includes two new pump stations, would increase delivery capacity to Baton Rouge from 107,000 barrels to 133,000 barrels daily.

Magnolia Pipe Line Company has contracted Jim J. McCormick and Company, Wichita Falls, Texas, to take-up 33 miles of eight-inch pipe and ten miles of six-inch pipe between Purcell to Shawnee, Okla., and to lay 25 miles of eight-inch line from Addington, Healdton and Fox fields, Okla.

Pan American Pipe Line Company plans to put 27 miles of 26-inch line between Genoa and Texas City, Texas, into service by the end of December.

Pasotex Pipe Line Company has contracted McVean & Barlow, Odessa, Texas, to lay 195 miles of eight-inch line to parallel the Wink to El Paso, Texas, line in operation since 1928. The schedule calls for completion this year.

Roosevelt Oil & Refining Corporation has announced plans to build 22 miles of four to six-inch line between St. Helens and Norwich, Mich.

Trans-Mountain Oil Pipe Line Company has assigned Missouri Valley Canadian, Winnipeg, the job of building a 24-inch line across the Fraser River. Construction of pump stations at Edmonton, Marlboro, and Kamloops has been awarded to Mannix, Ltd., Calgary. Completion of this Edmonton-West Coast line will be speeded up for operation October, 1953. With 150 miles completed in August, it is anticipated that more than 300 miles will be completed by the end of the year.

Products Pipe Lines

Salt Lake Pipe Line Company has awarded two contracts for its 330 mile line from salt Lake City to Boise, Idaho. Macco Corporation, California, will build 130 miles of eight-inch from Salt Lake City to Juniper, Idaho, the remaining 200 miles to Boise will be built by Engineers Ltd. Pipe Line Company, San Francisco. The new line parallels an existing line built two years ago from Salt Lake City to Boise and then continued on to Pasco, Wash.

Sun Pipe Line Company has awarded contract to Britton Contracting Company, Inc., Washington, Penn., to build 110 miles of eight-inch line from Fostoria to Hudson, Ohio. This line is scheduled for completion this year.

Natural Gas Lines

Allied Gas Company has announced it will build 24 miles of 6⅜-inch line from McLean County to Champaign County, Ill.

Central Illinois Public Service Company has given Somerville Construction Company, Ada, Mich., contract to lay 12 miles of six-inch pipe from Chrisman to Paris, Ill. The job was started in mid-August.

Columbia Gas System, Inc. subsidiaries have received temporary authorization from FPC for construction of 63 miles of line in Ohio, Pennsylvania and New York. The certificate authorizes Manufacturers Light and Heat Company to build about nine miles of line and to retire 15 miles in Allegheny, Washington, Beaver and Clarion counties, Penn. In addition Manufacturers may retire a compressor station in Lawrence County, Penn., and one in Columbiana County, Ohio. Another subsidiary, Natural Gas Company will build a total of 21 miles of line in Columbiana and Stark counties, Ohio, and retire two compressor units in Belmont County, Ohio. The third company, Home Gas Company, is authorized to build 33 miles of line in Chemung and Broome counties, N. Y.

Commonwealth Natural Gas Corporation has proposed construction of 537 miles of 20-inch line from West Bend, Ky., to Norfolk, Va.

Dow Chemical Company has contracted Mahoney Contracting Company, Lansing, Mich., to build 70 miles of various diameter pipe in the areas of Midland, Saginaw and Bay City, Mich.

Gas Lateral Company has applied to FPC for permission to build an undisclosed amount of four-inch pipe from the Texas Illinois Natural Gas Pipeline trunk to a distribution system in Monticello, Ill., which it proposes to build.

Hope Natural Gas Company of Clarksburg, W. Va., has been authorized by FPC to build 33 miles of 8, 10 and 12-inch line from Buchanan County, Va., to Hope's system in Wyoming County, W. Va.

Kansas-Nebraska Natural Gas Company, Inc., has retained Jayhawk Construction Company, Inc., Great Bend, Kansas, to lay 40 miles of 8, 10, 12 and 16-inch line from the vicinity of Garden City to Lakin, Kansas. Work got underway this fall.

Lopeno Gas Company has contracted Barry Construction Company, Houston, to take-up 20 miles of 12-inch and five miles of eight-inch line extending from the Lopena oil field to Roma, Texas. Lopena will import gas from Mexico to supply Roma.

Mississippi River Fuel Corporation plans to build 98 miles of 16 and 18-inch line from Wascom Field, Harrison County, Texas, to Lincoln Parish, La. Mississippi also plans to build 40 miles of 18-inch pipe between Dubach and Perryville, La.

Northern Natural Gas Company has filed application with the FPC for construction of 102 miles of pipeline and approximately 14,520 additional compressor horsepower which, part of the original construction program, was not included in the program approved by FPC earlier.

Ohio Fuel Gas Company has applied to FPC for permission to lay 14 miles of 10¾-inch line in Clark and Champaign counties, Ohio, to replace the existing 6⅝-inch Urbana pipeline.

Oklahoma Natural Gas Company approved plans to build 51 miles of 12-inch line from Bethany to El Reno, Okla.; from Henrietta to Morris, Okla.; and from Haskell to Muskogee, Okla.

Pacific Gas & Electric Company has filed for FPC permit to construct 15 miles of 12¾-inch line from a junction of its Stanpac-Sacramento and Ripon-Salida main line to a junction with the main line in the vicinity of Bangs Avenue regulator station.

Pacific Northwest Pipeline Company has filed a new plan to pipe gas to the Pacific Northwest area. The latest application calls for 1384 miles of main line and 316 miles of spur and lateral line originating from the San Juan Basin near Ignacio, Colo. The main line would pass through Salt Lake City, Pendleton, Goldendale and Portland, Ore., and Seattle and Bellingham, Wash. Eight compressor stations would be built at Ignacio, Gunnison and Dove Creek, Col., Green River, Wyo., Brigham, Utah, Burley and Boise, Idaho, and Pendleton, Ore.

Panhandle Eastern Pipe Line Company has applied for FPC authorization to build 20 miles of line and add 330 horsepower in compressor stations in Peoria County, Ill. The line will be built in Logan and Sangamon counties, Ill.

Peoples Natural Gas Company has proposed construction of 25 miles of line between Cambria and Blair counties, Penn.

Public Service Company of Colorado plans to build 95 miles of line from Douglas Creek and nearby gas fields to Grand Junction, Colo.

Public Service Electric and Gas Company of Newark, N. J. has filed application with FPC for permission to construct a total of 16.3 miles of pipeline between a connection with the Texas Eastern Transmission line and Harrison

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and Jersey City, N. J. Included will be 11 miles of 16-inch line extending from Linden, N. J., to Harrison.

Southern California Gas Company has announced plans to build 35 miles of line in Antelope Valley, Calif.

Southern Natural Gas Corporation, Birmingham, Ala., received temporary authorization from FPC covering construction of 88 miles of 24-inch loop line and five miles of 14-inch loop line. Southern had proposed construction of 1254 miles of line and addition of 22,250 horsepower in compressor stations in Mississippi, South Carolina and Georgia.

Texas Gas Transmission Corporation has applied to FPC for construction of 21 miles of loop from Oaktown, Ind., to service the Gas Utilities Company at Flat Rock, Ill., and the Illinois Gas Company.

Projects Starting

Crude Lines

Malco Refineries, Inc. has 60 miles of four-inch line underway between the Tocito Field near Pettigrew and Hospah Field in the San Juan Basin, N. M.

Natural Gas Lines

Atlantic Seaboard Corporation, Charleston, W. Va., granted temporary authorization by FPC, has begun construction of two compressor stations; one, a 5000 horsepower station and the other a 2640 horsepower station, will be built on the 26-inch line extending from Cobb, W. Va., to Rockville, Md.

Frederick Gas Company, Inc., with an FPC decision of approval, has begun building 26 miles of four-inch line to extend from Transcontinental system near Redlands, Md. to Frederick, Md.

Panhandle Eastern Pipe Line Company has underway 70 miles of 24-26-inch looping line between Sneed, Texas, and Emporia, Kansas.

Texas Power and Light Company authorized Bishop and Lock Construction Company, Dallas, to start construction of 60 miles of pipe, varying to ten-inches in dameter, between Waco and Groesbeck, Texas.

United Fuel Gas Company has 32 miles of 20-inch line between Lanham and Broad Run, W. Va., under construction by H. L. Gentry Construction Company, Jackson, Miss.

Projects Completed

Crude Lines

Continental Pipe Line Company announced completion of 105 miles of eight-inch line extending from Rincon Field, Starr County, to Port Isabel, Texas. Western Construction Company, Hobbs, N. M., did the construction.

Germany . . . Duisburg-Rugrorter Hafen, AG, a German construction company, is scheduled to complete 20 miles of main line and 21½ miles of branch line this month. The main line extends from the harbor at Duisburg-Ruhort to Gelsenkirchen-Buer for delivery to the Scholven-Chemie AG refinery. The branch line extends to the Gelsenberg-Benzin refinery at Horst.

Pan American Pipe Line Company is scheduled to complete 40 miles of 14-inch line extending from Arden Station, Irion County, to Eldorado Station, Schleicher County, Texas, this month.

Saskatoon Pipe Line Company, Ltd., has announced Piggott Construction Alberta, Ltd., Edmonton, will probably complete 57 miles of six-inch line between an Interprovincial Pipe Line connection at Milden and Saskatoon, by October 15.

Texas Eastern Transmission Corporation has announced completion of 774 miles of 30-inch line between Kosciusko, Miss., and Connelsville, Pa. Compressor stations along this line were placed in operation in August.

Texas New Mexico Pipe Line Company completed 28 miles of eight-inch line, and five miles of six-inch line near Hobbs, N. M., this month. Bishop and Lock Construction Company, Dallas, were responsible for construction.

Natural Gas Lines

Central Illinois Light Company was scheduled to complete six miles of eight-inch line near Washington, Ill., in September. Somerville Construction Company, Ada, Mich., completed the work and was also responsible for 20 miles of 20-inch near Peoria, Ill.

Niagra Mohawk Power Company, Syracuse, N. Y., is scheduled to complete 20 miles of pipe, varying in diameter from 10 to 20-inches, between Syracuse and a Tennessee Gas Transmission connection, sometime this month. H. L. Gentry Construction Company, Jackson, Miss., is the contractor. In addition, the company was scheduled to have completed 55 miles of 10-inch line being built by Williams-Austin Company, Pittsburg, between Fulton, N. Y. and Watertown.

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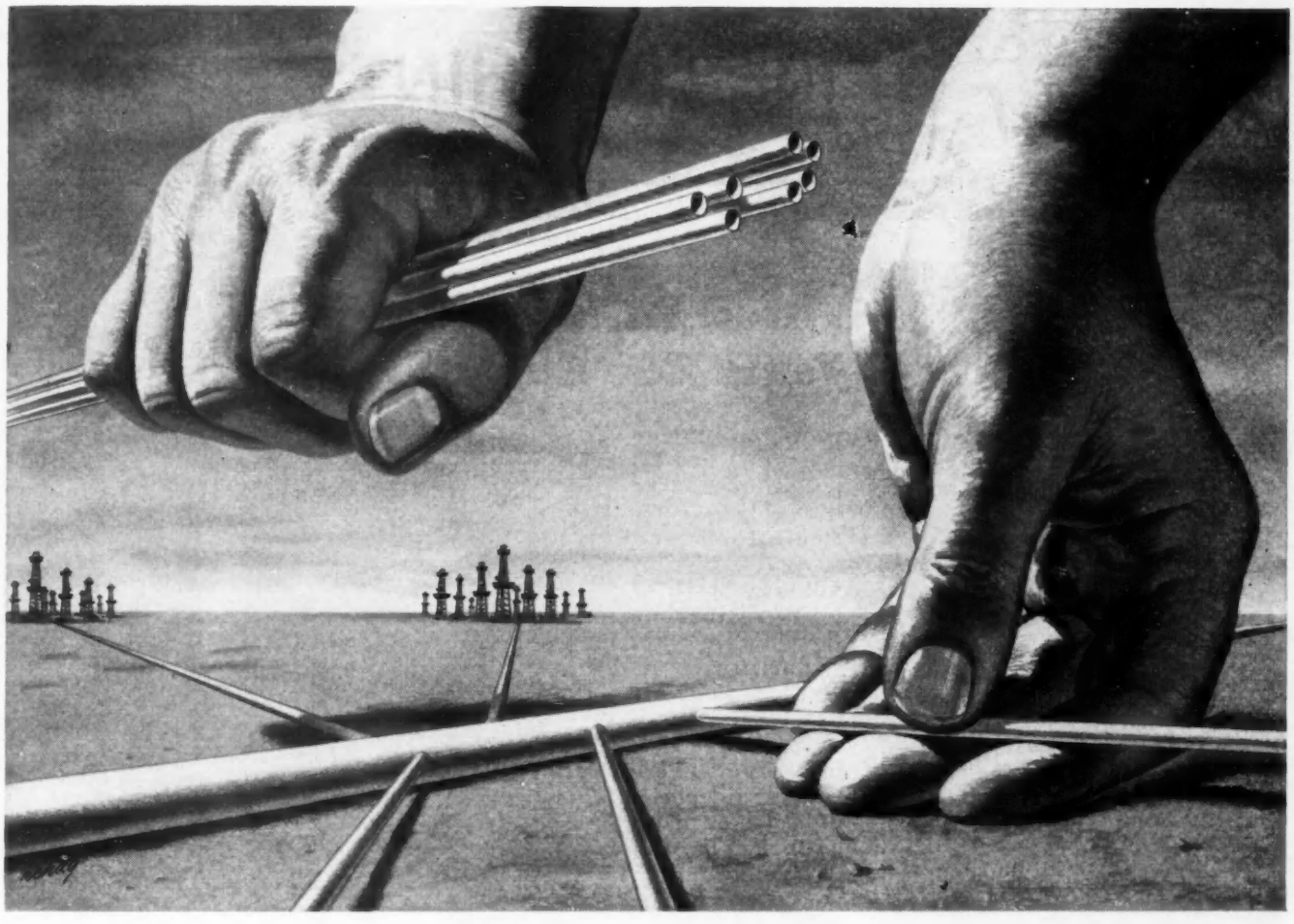

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Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
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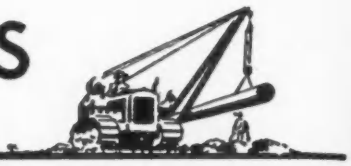
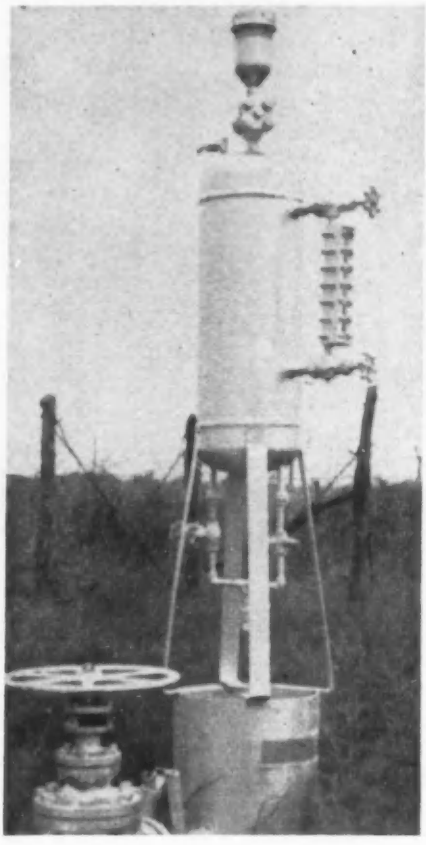
PIPE LINE HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas



This Injector Easy to Operate

Alcohol injectors, usually rather difficult to fill, gauge and drain, are converted into easily operated units with a few slight improvements. And since the purpose of the injector is to prevent freeze-up in gas pipelines in wintertime, there is a distinct advantage gained in simplifying the filling of the vessel and controlling the injection rate of alcohol. Consider adding the following improvements.

Few alcohol injectors are fitted with a one-inch filling valve on top of the small tank, as suggested in the photo. Topping this valve is a 4 x 1-inch swaged nipple which acts as a funnel, minimizing spillage and waste. Addition of gage glass will indicate the amount of alcohol in the tank, providing time for hauling before the supply in the tank is exhausted.

Incorporation of a one-half-inch graduated-type valve below the tank to the left permits injection of alcohol by gravity at a constant predetermined rate. The one-half-inch valve to the right is of the full opening type which permits a "slug" of alcohol to be injected rapidly when necessary. The connection to the line on the pictured valve is one-half-inch copper tubing which permits flexibility of mounting. The shield made of large diameter pipe protects the tubing and the one-half-inch tap and valve on the pipe. The tank is pressured up through the same line through which the alcohol drains. A one-quarter-inch valve permits bleeding the tank for filling.

Fitted With Steel Grating, Truck Can Carry Extra Load

A combination crew truck and gin pole truck can be modified to carry small tools and oxygen bottles by fitting a strip of steel grating into the poles.

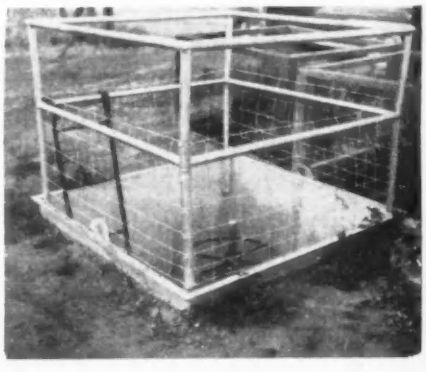
The grating is welded to three dowels made of extra-heavy one-inch pipe. These dowels fit into holes drilled through the gin poles. To protect the crew from the hazard of the sharp edges of the grating a rail was constructed of light metal rod.

When the truck is hauling crew, tools and other equipment, the sides are fitted onto the poles. When the crew arrives out on the job, the crew-cab can be demounted, the sides lifted out of the holes in the pole, and the gin-poles rigged.

Valve Box Cost Held to Minimum

Cost of underground valve boxes can be held to a minimum by prefabricating scrap steel boxes in the shop, then taking them to the field for installation.

Salvaged tank siding can be used by cutting it up and assembling it before it is taken to the field. Angle iron is welded around the top of the box to strengthen it. To make the box easier to handle, heavy ears of quarter-inch plate are welded to the upper edge of two sides. To simplify adding a protective fence or railing above the hole, a 12-inch length of 2- or 2½-inch pipe is welded into each corner, the upper end of nipple being flush with the top of the collar. Legs of the fence or railing can be inserted into these sockets.



Marker Serves As Fence Post

A combination pipe line casing vent, line marker, fence post and stile was used by Texas Illinois Gas Pipe Line Company at all road casings on the main line from Texas to Illinois.

Advantages of the multi-purpose vent are many. Pipe line walkers or airplane patrols can spot the sign as can maintenance or construction crews. The steps and hand hold save the landowners' fence when crewmen climb over it. Of course, the vent is required at all road casings.

These vents are made up in the welder's shop, using three-inch pipe. A piece of ¾-inch pipe is welded across the top and bent downward slightly for hand holds and vent outlet. Straps of 1¼-inch by ¼-inch strap iron are then welded to the sides for steps. This prevents damage to the fence wires when maintenance men cross it. The straps are fashioned in such a manner that the foot cannot slide off and cause injury to the linewalker.

The sign is attached by welding a piece of angle iron to the pipe and drilling holes through the pipe and the angle irons to hold the bolts for the signs.

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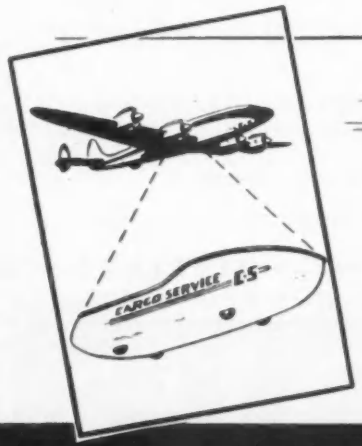

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Radio Utilized For Field Work

Put a spare two-way FM automobile radio to good use during purging and pigging and for off-shore communication by converting it into a portable unit. Since the two-way FM radio equipment is rather expensive, it is wasteful to let an emergency radio unit gather dust. Here is how the unit can do double duty as a portable radio.

A one-quarter-inch steel plate is bolted to the automobile mounting bracket and fitted with a handle for carrying. A bracket is added for the microphone, and a standard antenna mount may be utilized so that an auto antenna can be screwed in.

The unit is powered by a standard six-volt auto storage battery with fuse. The ends of the two leads shown connect to a battery, and no precautions as to polarity have to be observed. As a portable unit the radio rig comes into service during operations that require an observer in communication with other points, such as pipeline purging and pigging operations, by merely attaching the radio to a battery. When the unit is to be used temporarily to replace an automotive unit, the attachment plate is easily removed, permitting easy mounting in the vehicle. The two leads are then connected to the auto electrical system.

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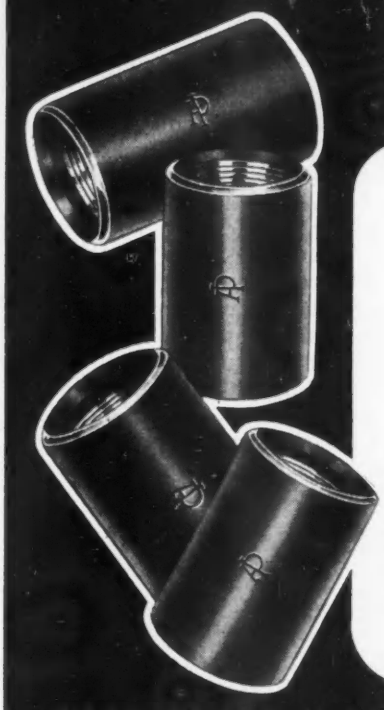

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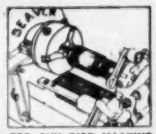

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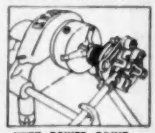
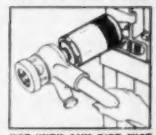
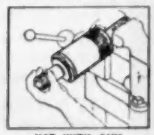

WITH POWER DRIVE—CUTS ANY SIZE NIPPLE


USE WITH ANY PIPE VISE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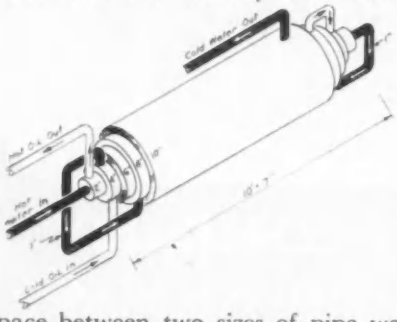
Heat Exchanger Is Economical

A heat exchanger made of line pipe has saved one company about $900 per year in electrical bills, by replacing an electrical heater used to preheat crude oil before it was centrifuged for use as diesel fuel. It utilizes heat from the engine jacket water.

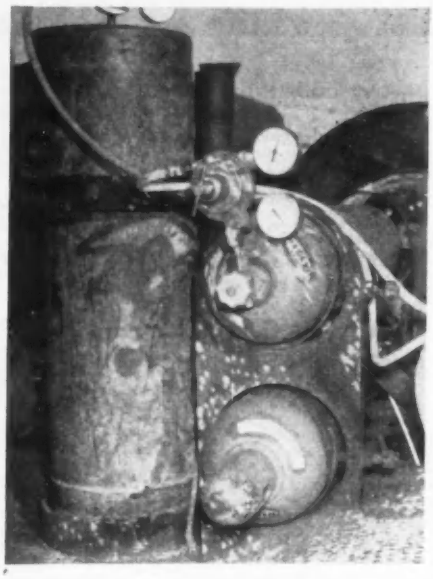
The exchanger and piping from the engine cost the company $115: $60 for materials and $55 for labor. It was made from 10-foot 7-inch lengths of different sized line pipe. Each section formed by the annular



space between two sizes of pipe was sealed at each end .

The streams of hot jacket water and of cold crude oil were piped countercurrent. Three sections of the exchanger were piped for water and two sections for the oil.

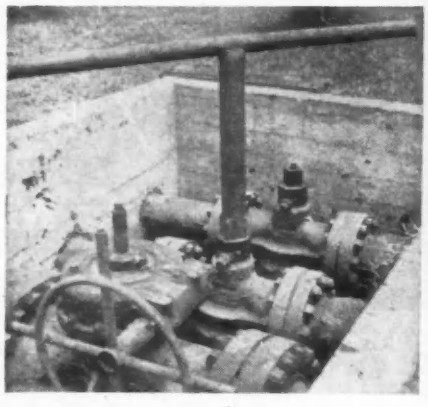
Installation of this unit at a diesel powered station not only provided necessary heat for fuel oil but also provided additional cooling for the engine jacket water.



Rack Steadies Oxygen Bottles

Oxygen bottles can be mounted so they will not shift or bounce around during rough service trips to which field welding trucks normally are subjected. An encircling band tightened against the bottle by a set screw, holds the bottles in place.

Visible in the accompanying photograph, the bands provide the inner "lining" of the round openings of the channel iron rack and through which the bottles are loaded. The band, spot welded to the rack, actually overlaps its point of origin by several inches. The last 10 to 12-inches of the band being free, it easily is pressed around about one-third of the bottle's circumference when the set screw is turned down. The wrap of the band on that portion of the bottle, plus the pressure exerted against the rack on the back side combine to grip the bottle firmly. Turning the set screws does not damage the bottle. Tightening the jam nut on the set screw insures that the units will remain there, and without damage, until removed from the rack.



Long Handle Makes Work Easy

Extending the handle of the standard valve wrench will give the operator a decided advantage when working on valves located in valve boxes. The wrench shown in the accompany photograph was modified by adding an extended handle which eliminated awkward positioning for the operator.

Large valves, such as those shown in the photograph, are not opened or closed frequently and they become hard to operate. One method of reducing these complications in the event of an emergency was accomplished with this box type wrench which is made up of a two-foot section of three-inch pipe with a five-foot section of two-inch pipe welded on top of it. The lower section is simply a box arrangement, 2⅝ x 2⅝ x 3 inches, welded to the base of the three-inch pipe.

By placing the wrench over the six-inch valve shown in the photograph, the valve is opened efficiently and with minimum effort.

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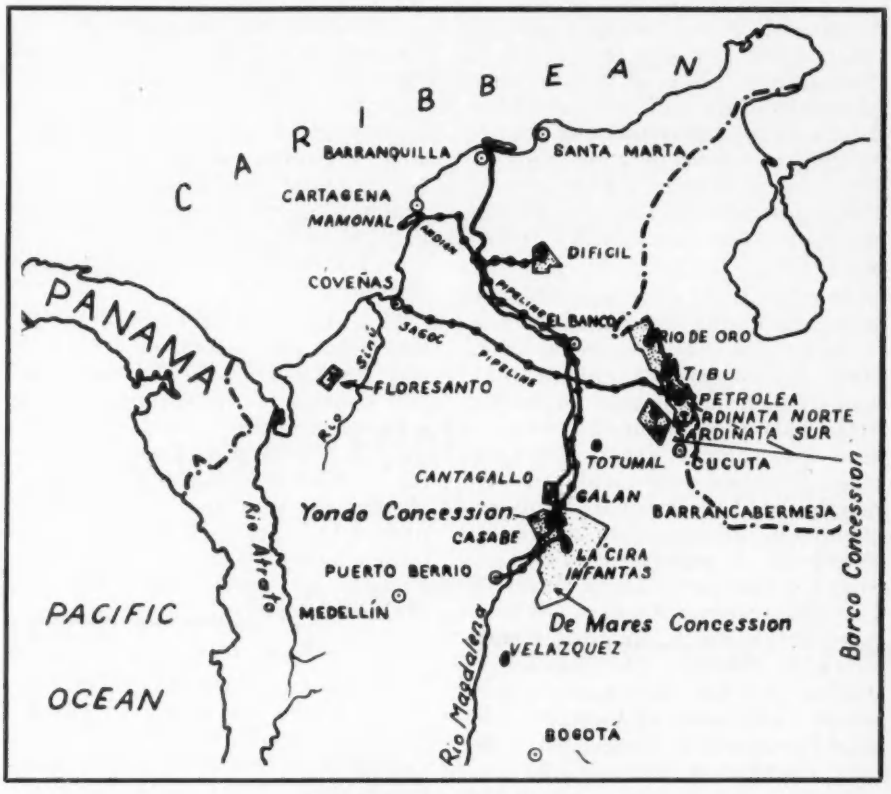

Colombia's oil producing areas.

Colombia—the Gem of the Future?

By DR. VICTOR OPPENHEIM

Consulting Geologist and Engineer
Bogota, Colombia

WITH AN estimated 50 million acres of likely oil country, Colombia can become an important oil producer. This vast territory comprises five sedimentary basins—the Llanos, Magdalena, Southern Maracaibo, Northern Coastal and Pacific-Atrato—all of Tertiary age from which most of the world's oil has been produced.

With the exception of the Magdalena Basin, these areas for the most part have been scarcely scratched from an exploration standpoint. Since 1905 it is estimated that only about 200 test wells have been drilled. These have mostly been shallow boreholes, often grouped together in isolated areas, or in the vicinity of oil seeps.

Principal factors accounting for Colombia's backwardness in oil development are:

- Insufficient exploratory drilling.
- Lack of a "healthy atmosphere" so necessary to attract independent oil operators.
- The government's slow and cumbersome oil policies.

The sedimentary basins appear to be underlain by marine Cretaceous or also marine Eocene or Oligocene strata. The vastness of the basins naturally implies considerable variations in the thickness of the sedimentary cover. In the areas of consideration the thickness of the sediments is known to be amply favorable for large oil accumulations and, in some instances, may reach 20,000 feet or more.

The prevailing structures mostly traceable from surface observations are anticlines or faulted anticlines that appear conspicuously in all the basins, frequently over extensive areas. However, all other forms of oil traps are evidently present: the Dificil production comes from an Oligocene reef; the Casabe field produces from unconsolidated sands ranging in age from Eocene to Miocene; the De Mares Concession produces from faulted anticlines of Eocene and Oligocene ages; the Barco Concession produces from Cretaceous and Eocene faulted anticlines and domal structures.

Oil seeps and tar sands are found in all the basins, and in some they appear particularly numerous. The development of the De Mares, Barco and Floresanto concessions was encouraging and begun through these surface petroleum indications.

The source of Colombian oil is not of Cretaceous age alone, as was believed in the past. Eocene and Oligocene formations have been found more recently to represent undisputed source rocks in some areas of the basins. Cretaceous production of the Barco Concession and the recent discovery of Cretaceous production in the new Totumal field indicate that Cretaceous source and reservoir beds could be widespread in various hitherto unsuspected areas of the basins.

The Totumal discovery should certainly encourage deeper exploratory borings where, until now only near surface wildcatting was considered as a conclusive test. This has been frequently the sole test for a whole concession tract of 120,000 acres of a virtually untested prospect.

The 17 Colombian oil fields are

distributed through seven producing concessions; one in the Northern Coastal Basin, one in the Southern Maracaibo Basin and five in the Magdalena Basin. The concessions granted by the government each contain 123,500 acres, in all parts of the country except the Llanos of eastern Colombia, where they can contain 247,000 acres each.

At present, the more accessible and geologically suitable areas of the sedimentary basins are covered by about 500 concessions and private land leases, which include those in production, exploration or subject to future, final government exploration contracts. They are owned and controlled mainly by International Petroleum Company of Colombia, Richmond Petroleum Company of Colombia, Shell Oil Company, Texas Petroleum Company, Socony-Vacuum Oil Company de Colombia, Empresa Colombiana de Petroleo (De Mares Concession) and the Allen Guiberson interests (Floresanto II Concession). The Floresanto II Concession is the only exploratory concession now owned by private interests in Colombia.

Although at one time Colombia was believed to have better petroleum possibilities than Venezuela, its production to the end of 1951 was only 38,148,929 barrels as compared to Venezuela's 622,187,171 barrels. The two neighboring countries, though topographically different, have geologically much in common. Some sedimentary basins are shared by both countries. Their past petroleum development and policies have, however, followed radically different courses.

It is noteworthy to point out that the development of the main producing Colombian oil concessions took an unusually long period of time. Petroleum activity began in Colombia in 1905, when the government granted to the Frenchman, Robert De Mares, a large tract of land on the Magdalena River, which later became known as the De Mares Concession.

However, it was not until 1916, when De Mares transferred his concession to the Benedum-Trees interests of Pittsburgh, that an operating company (Tropical Oil Company) was formed with rights to the 1,264,000 acres of the concession. But exploitation of the concession did not begin until 1922, when it was again transferred, to the Standard Oil Company of New Jersey. The concession initiated its full scale production only in 1926, when the pipe line to Mamonal, near Cartagena, was completed.

The original contract with the government, which was for 30 years, lapsed in August of 1951. The concession is at present operated by the Empresa Colombiana de Petroleo under the technical supervision of the International Petroleum Company, which also operates the Barranca Bermeja refinery and owns the Andean National Corporation's 669-mile pipe line.

In 1951, the four oil fields of the concession had a total of 1042 wells and produced 13,591,089 barrels of oil. Cumulative production of the concession at the end of 1951 was 416,978,870 barrels. Thus, it is producing about 40 percent of Colombia's oil, but the estimated reserve of the proved 18,711 acres is only about 125 million barrels. It can be assumed that this does not cover the ultimate possibilities of the entire concession.

Barco Concession

The Barco Concession on the Venezuelan border was originally granted to Señor Virgilio Barco in 1905 and extended over about a million acres. Señor Barco was unable to prove and develop it, and in 1917 transferred his concession to the Henry Doherty interests, which formed the Compañia Colombiana de Petroleo.

This company drilled the first producing well (1500 barrels) at Rio de Oro in 1920. After a long period of inactivity the operating company, in turn, transferred the Barco Concession, in 1931, to the Gulf Oil Corporation. The latter, not convinced of the possibilities of the concession at the time, sold it to the Colombian Petroleum Company, owned jointly by the Socony-Vacuum and Texas Petroleum Companies.

The concession has since been reduced to 460,000 acres. The South American Gulf Oil Company, however, operates the 263-mile, 12-inch pipe line which connects the concession with the Caribbean port of Coveñas. The seven oil fields developed on the concession had 123 producing wells at the close of 1951 and an annual production at the end of the year of 18,103,735 barrels. Cumulative production at the close of 1951 was 73,474,117 barrels. Total proved area is estimated at 23,710 acres. Ultimate reserves are estimated to be very considerable.

The Yondo Concession contains the third largest oil field in Colombia, the Casabe field, which was discovered in 1941. The concession of 120,000 acres faces the De Mares Concession and is situated in the Departmento de Antioquia on the west side of the Magdalena River. Originally, it was held by the Tropical Oil Company by virtue of a 1938 government contract. After several years of geological and geophysical surface work and several borings, the concession was released and abandoned as non-commercial in 1940.

After being transferred by the government to the Shell Oil Company, the latter discovered what is now known as the Casabe field. In 1951 the field had 259 producing wells with a total 1951 production of 12,832,905 barrels. The steadily growing output of the field presently accounts for more than 30 percent of Colombian crude. Cumulative production of the estimated 5000 proved acres of the Casabe field was 44,025,613 barrels at the end of 1951. Reserves are substantial.

The newly-discovered Totumal field is another example of unexpected achievement. The Totumal Concession, covering about 120,000 acres in the Middle Magdalena Basin in the Department of Magdalena, was originally registered as Application No. 142 and was owned by the Richmond Petroleum Company. Released in 1948, it was granted by the government to International Petroleum Company. The field was discovered by the company with its first wildcat (1100 barrels per day) in November of 1951.

The discovery well was completed three months after the company had returned the De Mares Concession to the government. Although the potential of the field is as yet unknown, the Totumal well has revealed the presence of important and hitherto unsuspected Cretaceous production in the Magdalena Basin.

The history of the three main concessions of Colombia which account for almost all of its production indicates that the real development of Colombian oil reserves is still in its initial stages. New fields with many times the present production can be expected in the future.

Although Colombia's daily production for 1951 was 105,346 barrels, estimated present potential of combined fields is 124,000 barrels per day. Yet, production is greatly limited by pipe line and refinery capacities.

Of the four crude pipe lines totaling 993 miles only two serve as outlets to the Caribbean coast.

- The South American Gulf Oil Company's 12-inch pipe line from Petrolea to Coveñas extends for 263 miles with 28,000 barrels per day capacity.
- The Andean National Corporation's 10-inch and 12-inch pipe line

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from El Centro to Mamonal extends for 669 miles with 65,000 barrels daily capacity.

The other two pipe lines connect the Casabe and Dificil fields of the Shell Oil Company to the main Andean National Corporation's pipe line. They have a capacity of 50,000 barrels and 12,000 barrels per day, respectively. The 10-inch pipe line from Casabe to Galan extends for only six miles. The 6- and 10-inch line from Dificil to Plato runs for 55 miles.

With the serious limitations of the existing crude carrying pipe lines, further expansion of production will have to be restricted, and with it wildcat activity in areas distant from the coast. Unless new substantial discoveries are made, it is unlikely that existing pipe lines will be enlarged. The great cost of pipe line construction in Colombia, due to its very broken topography, naturally limits the search for oil and wildcatting to the more accessible parts of the country.

Only two products pipe lines are operating. The International Petroleum Company's 65-mile, 6-inch line from El Centro to Puerto Berio along the Magdalena River with a capacity of 7500 barrels a day and the Department of Cundinamarca's 22,000-barrel-a-day, 87-mile, 6⅝-inch line from Puerto Salgar to Bogota. An additional 280 miles of product line are projected or under construction and will connect Buenaventura with Cali, Puerto Berio with Madellin, and Puerto Berio with La Dorada.

Two refineries are operating in Colombia. The Barranca Bermeja 25,000-barrel-per-day topping and catalytic cracking plant serving the De Mares Concession is now owned by the Empresa Colombiana de Petroleo. At present it is operated with the technical help of the International Petroleum Company and is being enlarged for a capacity of 35,000 barrels per day. The second refinery is a small 900-barrel-a-day skimming plant on the Barco Concession at Petrolea. It is owned and operated by the Colombian Petroleum Company.

A natural gasoline plant with a capacity of 20 Mmcf. of gas daily is being built by the Shell-Condor Company at Dificil. A 1000-barrel-a-day pilot plant is scheduled by the government.

The present refining capacity of Colombia is therefore limited to 25,900 barrels daily, which is inadequate for domestic requirements. Thus, substantial amounts of refined products are imported, mainly for the consumption of the northern coastal and western Pacific parts of the country. Paradoxically, gasoline and lubricating oils for local use are being imported by the International Petroleum Company from its refineries in Aruba and Curacao, while about 80 percent of the country's crude is exported through the northern coast's Coveñas and Mamonal terminals.

Consumption of the Pacific and southern parts of the country is supplied by the International Petroleum Company's imports from its refinery in Talara, Peru, through Buenaventura. Thus, the Barranca Bermeja refinery scarcely supplies the capital and the central, most populated part of the country. The remainder of the country consumes largely imported products.

This unusual condition for a country of as great a potential as Colombia is largely due to topographic barriers and inadequate transportation systems, particularly between the northern and southern parts of the country; and lack of adequate wildcat exploration in the Pacific-Atrato and Northern Coastal Basins, which, if developed, could make these regions independent of imported products.

Smaller competitive refineries in the coastal areas would probably lend the best solution to this problem of local supplies.

Annual Colombian petroleum production at the end of 1951 of 38,148,929 barrels equaled 0.91 percent of the world total for the same year. Considering that to the end of 1941 it was less than 10 million barrels a year, production increased four fold in ten years through comparatively limited development and exploration activity. The 1951 production figure has been accounted for by 1450 producing wells including 157 flowing. Possibilities of future production were indicated by the discovery of three new fields in 1951 and a sharp rise in crude output over 1950.

Colombian cumulative production to the end of 1951 was over 542 million barrels. The estimated maximum petroleum reserve based on data available in 1941 was but 500 million barrels.

Although exact figures of proved reserves are not available, it is evident that, in view of the estimated possibilities and recent discoveries, previous estimates will have to be revised. The true potential production may be several times that of the estimated 1941 "maximum." Final data on proved reserves will, however, have to await future development. More intense wildcat exploration and sound petroleum policies will not fail to multiply the present production and the estimated potential reserve of Colombia.

About the Author

VICTOR OPPENHEIM, consulting geologist and engineer, was educated in France. With his present headquarters in Bogota, Colombia, Oppenheim was formerly consulting geologist and engineer to the governments of Argentina, Brazil, Peru, Ecuador (ad-Honorem) and Colombia. He also has been visiting geologist with the Uruguayan, Venezuelan and Bolivian governments. Former geologist with several major oil companies in South America, Oppenheim now is acting consultant for independent petroleum interests.

He has written about 100 papers, monographs and articles on South American geology, and is a fellow or member of the Geological Society of London, Society of Economic Geologists, American Association of Petroleum Geologists, Geological Society of Peru, Academy of Science of Columbia, Swiss Geological Society, American Institute of Mining and Metallurgical Engineers, American Geophysical Union and Colombian Petroleum Institute.

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Latest Efforts Fail To Settle Iran Issues

Mossadegh's actions indicate he's out to drive hard bargain for best terms.

LIKE the unsuccessful attempt to repair the proverbial Humpty Dumpty, all the Queen's diplomats and proffered American taxpayers' $10 million loan so far have made no assured progress in putting the Iranian oil industry together again.

While the latest series of negotiations between the British and Iran in September appeared to be moving towards some degree of success, actions of the Iranian nationalists to date would indicate that any possible resulting settlement must be viewed with extreme skepticism until the reaction of the Iranians can be fully tested.

Iran's Premier Mossadegh, since his return to power in recent months, has left the impression that despite all attempts of the British (pushed by the U. S. State Department) to reach an agreement and the numerous reported offers from other sources to buy Iranian oil, he is a hard bargainer and will only settle for the best terms.

Another impression is that, regardless of how favorable to the Iranians the final British offer may be, Mossadegh is in no position to reach agreement with the previously-expelled Anglo-Iranian Oil Company for fear of his physical and political life.

The general run of reports from Iran last month sounded like a dull repetition of what had gone on in the previous 19 months since the "nationalization" was effected with continued negotiations amid "news" of offers to buy Iranian oil by outsiders. The latter reports in September for the first time, however, had some semblance of reality. Previously, such reported contracts were always with buyers whose ability to complete the sale depended on non-existent tankers.

This time the presence at the Teheran bedside of the white-gowned Mossadegh of W. Alton Jones, president of Cities Service; Gerald Waldron and Richard Nelson, Denver businessmen; and Ray Carter, a New York tanker and oil broker, indicated a real possibility of Iranian oil exports. Also in Iran to talk oil was another New York businessman, William L. Taub, reported to represent an American oil "syndicate," as were officials of the oil-short Brazilian government.

The Jones mission drew widespread comment, however, shortly after the Cities Service president left Teheran:

- Keihan, a leading Teheran newspaper, said, "If there is an agreement between the Iranian Government and the Jones mission, the Cities Service Company will administer the Abadan refinery and oil installations on behalf of the Iranian Government. In effect, the Cities Service Company will be an agent of Iran and will receive remuneration from oil revenues for its services."

"The Cities Service Company, which thus far has confined its operations to the U. S. and Mexico, may try to enter the European, Far East and Southeast Asia markets and thus the oil war may assume a new form."

- Bakhtar Emruz, a Mossadegh National Front organ, said, "Mr. Jones' arrival . . . will have important repercussions on American foreign policy in regard to Iran. According to our reports, the company has promised the premier that if Iran is ready the company can operate the Abadan refinery with the help of neutral technicians . . ."

- The Cities Service Company declined comment on the Teheran press statements; however, Paul S. Watson, executive vice president of the company, said, "Cities Service has no financial or other interests in the Middle East." He added that Jones' only motive in discussing the oil crisis with Iranian officials "would be a desire to make any contribution he could toward a solution of a difficult world problem."

- The U. S. State Department's press officer, Michael J. McDermott, said only that Jones had acted fairly with the State Department in informing officials in advance of his visit, where he was going and what he intended to do. McDermott said these matters were Jones' own private business and that the State Department was in no position to divulge them.

Should any of the various negotiations — those with the British and AIOC or those with possible outside buyers — meet with success, Iran's complete bankruptcy, which has been predicted every month for the past year and one-half, may be avoided and the nation saved from possible communist envelopment.

At best only a temporary salvation would be found and, as pointed out in WORLD OIL previously (see WORLD OIL, September, 1952, page 306) should any solution ignore the basic legal question of outright abrogation of contract that occurred with "nationalization" then other oil concessions around the world, and particularly in the Middle East, would be in danger. The gravity of this possibility would definitely outweigh the value of any expedient measure to get oil moving from Iran again purely to keep the nation solvent and non-communist.

The renewed efforts of Britain and Iran that started in mid-September following the flat rejection by Iran of the Churchill-Truman proposals to get oil flowing and then take the issue of arbitration for compensation due AIOC for its nationalized properties to the World Court, appeared to rest entirely on whether Mossadegh would agree to meet the British halfway. His position at the outset of new attempts for settlement was that the British must agree to limit in advance its claims against Iran while no ceiling would be placed on the latter's possible claims against AIOC.

The chief issue continued to be whether Britain would be willing to forego arbitration before the World Court on claims for the losses of future revenue suffered through Iran's cancellation of the 1933 oil concession, originally scheduled to run until 1993.

Equally important is the Iranian demand that Anglo-Iranian immediately turn over the sum of $137,200,000 that has been accumulating on the company's books as additional royalties that would be due Iran under the AIOC proposed 1949 Supplemental Agreement to the concession contract. The pact was first accepted by the Iranian Government, but Iranian nationalists prevented the proposal being introduced for a vote by the Iranian parliament, whose approval under the basic terms of the concession was required for formal ratification.

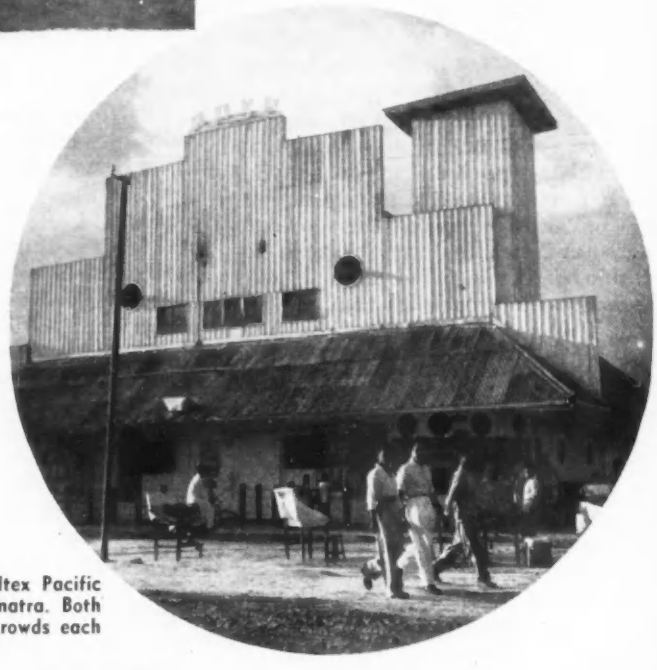
Standard-Vacuum's clubhouse at Sungei Gerong near Palembang in southern Sumatra.

This feature, one of a series describing important oil camps or cities throughout the world, is intended only to describe living conditions and to give a bit of the local atmosphere. While an occasional one of the features may touch lightly on working conditions, it will do so only incidentally.

So This Is . . .

INDONESIA

By ROBERT E. SPANN
WORLD OIL Staff



RIGHT. One of the chief amusements for employes of Caltex Pacific is the motion picture theatre at Pakenbaru in central Sumatra. Both American and Indonesian pictures are shown to capacity crowds each night.

Employes' homes at Standard-Vacuum's tanker stopping terminal at Tandjong Uban in the Riouw Archipelago.

OIL companies operating in the Republic of Indonesia have the "help wanted" signs up for young engineers with some petroleum industry experience. Personnel recruiters are quick to say, though, that they are looking only for men with highest qualifications who are interested in a career. They are not seeking the short-termers who may want foreign employment for the change connected with a job half-way around the world in the Orient.

Chief inducements are generally better opportunities for advancement and higher pay, which may average upwards to 25 percent above U. S. rates. Chances are, too, that a large portion of their salaries can be

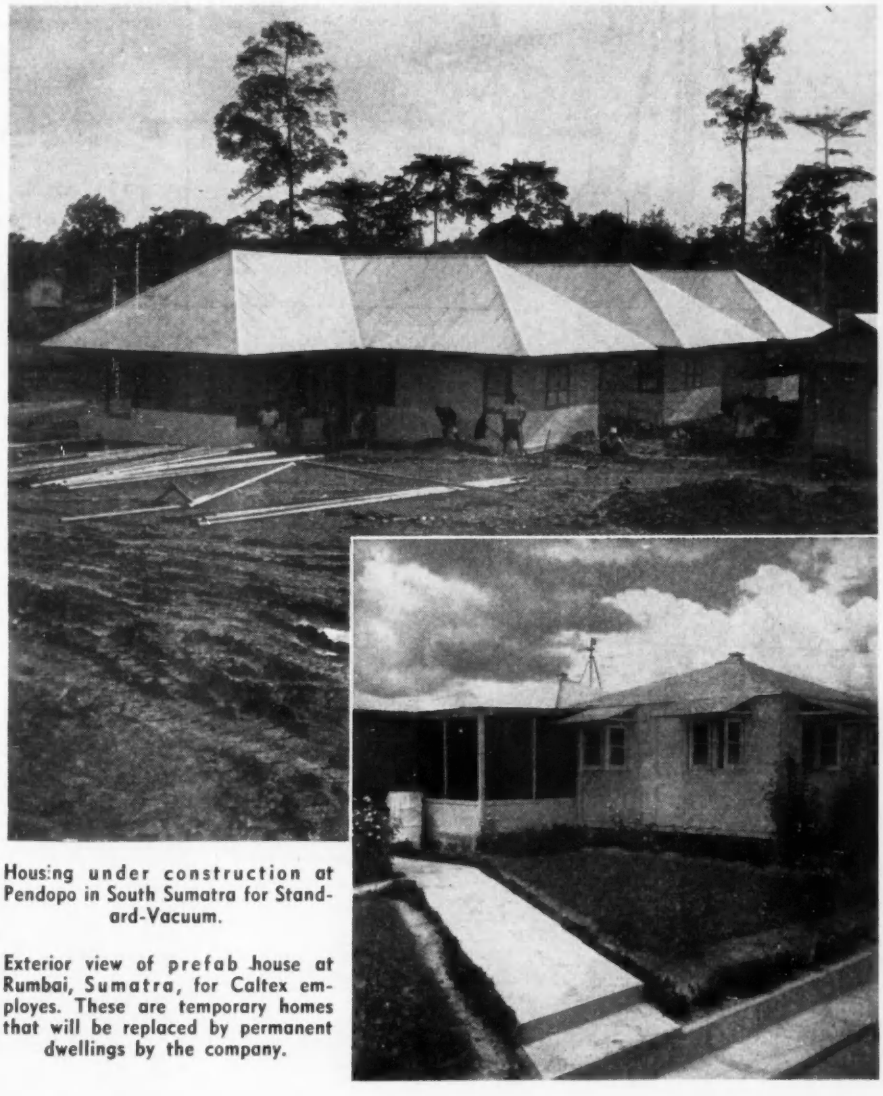
saved. Applicants who pass the rigid screening tests that eliminate all but the well-rounded, level-headed persons will find themselves associated with a petroleum industry only a quarter of a century younger than that in the U. S. And future expansion possibilities are bright.

Equipment used in the field is the best. Among the approximately 30,000 employes in the industry, those in top, near-top and supporting positions are capable individuals who are just completing the rebuilding of facilities from the ashes of near total war-time destruction.

While the new recruit will discover that operations in the field are technically similar as in Texas or California, he will soon learn that in order to keep equipment running smoothly his resourcefulness and ingenuity will be taxed to the utmost. While modern communications exist in the field comparable to that in the U. S., supply houses and outside servicing crews cannot be reached by telephone. The only spare parts available are those in company warehouse and, with limited exceptions, servicing and other necessary operations have to be performed by the forces at hand.

Despite its location on the equator, about equidistant between Australia and India, the newcomer will find the climate of Indonesia milder than usually expected in the tropics—though possibly monotonous with the year-round range between 80 and 90 degrees. Living, while away from cities in company-provided camp housing near the scene of operations, will be found comfortable.

Normally, a new employe is sent ahead to his job, but he can expect his employer to transport his family to Indonesia shortly afterwards, or as soon as housing is available. It takes only a short time in Indonesia for the newcomer to begin to appreciate the substantial investments in other than strictly operational requirements that his employer has made to make life as near like back home as possible.



Housing under construction at Pendopo in South Sumatra for Standard-Vacuum.

Exterior view of prefab house at Rumbai, Sumatra, for Caltex employes. These are temporary homes that will be replaced by permanent dwellings by the company.

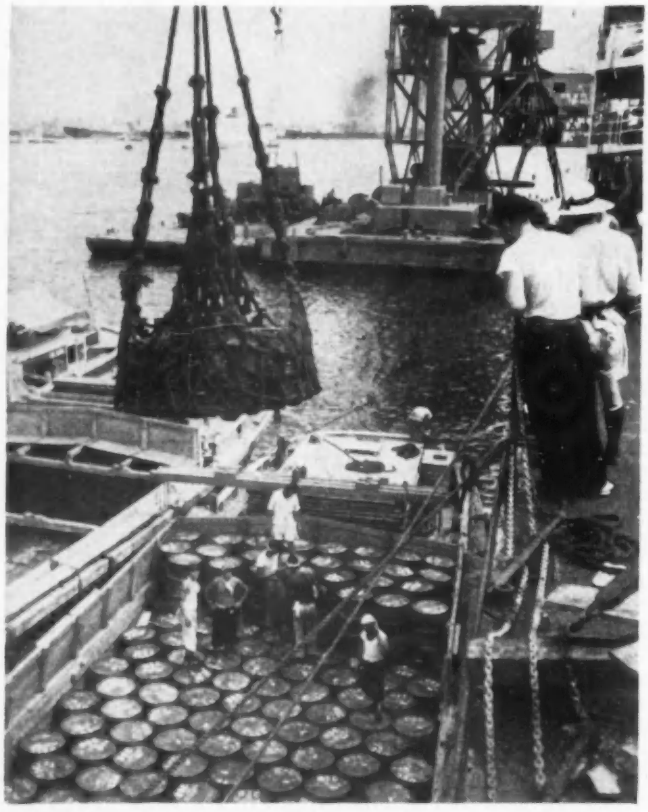
Creating a home for employes is more than building houses. It includes a company store, not like the supermarkets commonplace in the U. S., but adequately stocked with wares, almost all of which are imported. It includes recreational facilities, as good as found in any small town of much larger population, schools, hospitals and churches. Well-trained medical and teaching staffs are provided. Except for occasional shopping tours to the principal Indonesian cities, such as Djakarta or Palembang, or across the Straits of Malacca to Singapore, the usual day-to-day requirements for living are available in company-operated stores or commissaries.

The tour of duty abroad varies slightly among the companies—N. V. Standard-Vacuum Petroleum Maatschappij, N. V. Caltex Pacific Petroleum Maatschappij and N. V. de Bataafsche Petroleum Maatschappij, the latter a Royal Dutch-Shell company. A furlough back home of about two months for each year in the field can be expected with the minimum tour of duty two years. In non-furlough years, each employe is allowed a two-week local vacation.

Caltex-Pacific's commissary at its Central Sumatra operational location of Rumbai.

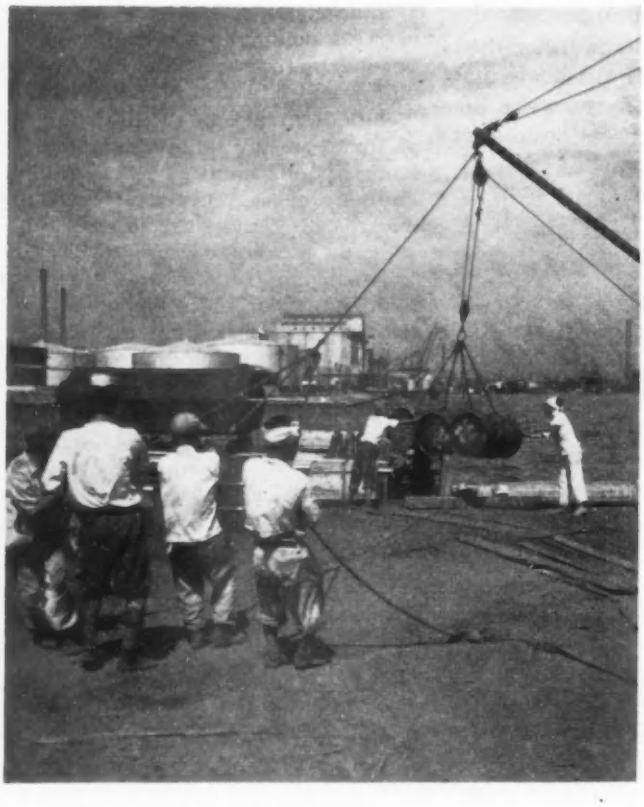
Stocking Up in Japan

THESE U. S. Army photographs tell their own story of the oil industry's major role in supplying products to the Far East and the arena of combat surrounding the Korean police action. These photographs were taken by Capt. A. D. Bruce, Jr., formerly with Humble Oil & Refining Company, and photographers at the Yokohama Petroleum Depot, Yokohama, Japan.

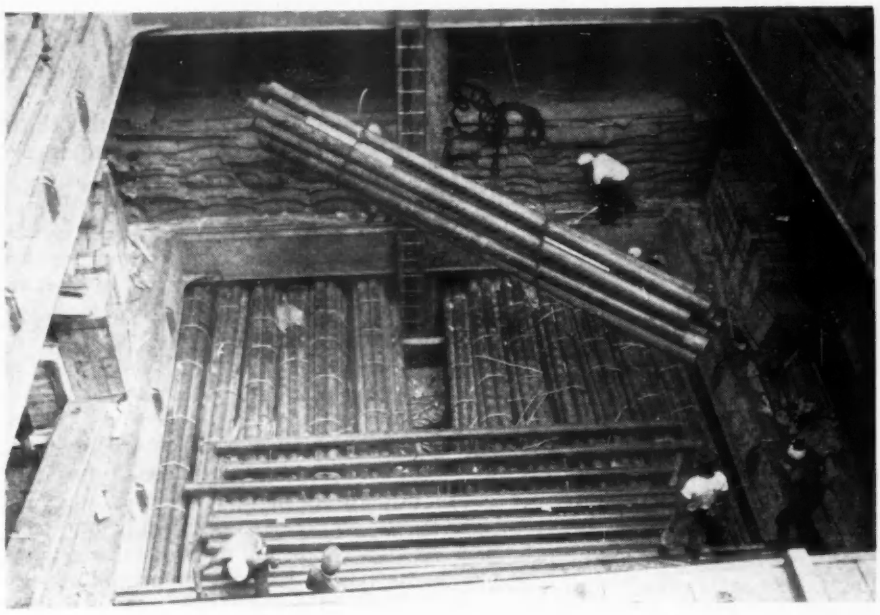


Standard Oil Company of California lubricating grease is unloaded onto a barge already containing Northwest Gas and Oil Company steam cylinder oil.

Small U. S. Navy tanker takes on aviation gasoline and motor fuel at Takaracho terminal at Yokohama depot.



Japanese stevedores await their turn to roll away oil drums as they are unloaded at Yokohama Petroleum Depot.



Pipe is removed from hold of the J. L. Luckenbach, docked at pier of 2nd Transportation Major Port at Yokohama.

Capt. A. D. Bruce, Jr., who with staff of photographers took these pictures, tries Oriental method of carrying oil cans.

Japanese workers stack five-gallon cans of engine oil.

Another stockpile of engine oil, this from The Texas Company.

Monopoly in Brazil

Vargas closes door to foreign companies. What's ahead for nation's oil industry?

"O petroleo e nosse."

This shout, "the petroleum is ours," rang out from the nationalists of Brazil last month in celebration of the party's victory in forcing through the House of Deputies legislation establishing petroleum exploration, exploitation, refining and transportation as a state monopoly under control of the government entity, Petroleo Brasileiro S. A.

President Getulio Vargas, in his previous administration, all but nationalized the petroleum industry through a series of decree laws from 1937 through 1941, limiting foreign participation to marketing of products in Brazil. He originally sponsored numerous amendments to the new law during its enactment making it even more nationalistic than was first proposed. Both Vargas and some officials of Conselho Nacional do Petroleo (National Petroleum Council), the government's policy-making group on petroleum affairs, previously had said Brazilian and foreign private capital would be allowed a minority participation in the new government company to be formed.

Under the new law sole exceptions to a complete state monopoly in the petroleum industry is the authorization permitting previously-granted refining concessions to native-born Brazilians to continue. These concessions cannot be renewed, however, and at their termination Petrobras is authorized to take over the plants. The company also is authorized to purchase 51 percent of the stock of any privately-owned refining entity. No further expansion of the private plants will be allowed.

Private capital companies, including foreign, may continue marketing operations in Brazil. But the Vargas-decreed economic restrictions limiting the taking of profits out of Brazil make their continued existence uncertain.

Specifically, the new law creates the following as a state monopoly:

- The search for and exploration of petroleum deposits, other fluid hydrocarbonates and rare gases.
- The refining of national or foreign petroleum (with the previously stated exceptions).
- The maritime, fluvial or lake transportation of national crude or petroleum products produced in the country, as well as pipe line movement of crude oil and its by-products and rare gases, whatever their origin.

The new law is not expected to result in any immediate drastic changes in the Brazilian petroleum industry. Though previously open to private Brazilian capital—companies whose shareholders are 100 percent native-born—exploration and production of oil has been entirely in the hands of the National Petroleum Council since the first restrictive decree laws of the previous Vargas regime in 1937. These were followed by other decrees and a new Mining Code in 1940, with a petroleum exploration and exploitation section in 1941. This also limited exploration production and refining operations to Brazilian companies and the National Petroleum Council. Six privately-owned refineries, in addition to two government-owned plants, were in operation or planned for construction prior to the new 1952 law. No producing companies were ever established.

The new law kills all hope of potential foreign investors that had existed in the past five years that some participation would be granted them in developing Brazil's oil resources. Shortly after the ouster of the previous Vargas rule in 1945, President Gasper Dutra's government gave Brazil a new constitution in 1946 that removed restrictions on foreign capital participation in natural resources deveolpment.

Legislation, drafted with the aid of several foreign companies, to implement the new Constitutional provision was prepared and presented to a Dutra-appointed committee. Numerous changes by the committee—all unacceptable to potential foreign investors—prevented the bill from becoming law.

While Brazilian nationalists prior to and after the present Vargas administration fought the issue of allowing Brazilian oil to "fall in the hands of foreign trusts," the nation has done little to develop its petroleum. With vast areas rated by competent geologists as possible oil-producing regions, the nation has conducted only an extremely limited exploratory drilling campaign with most of the effort restricted to the Bahia basin on the East Coast, where all of the present production is found. Based on the limited knowledge indicated by previous drilling, oil reserves of Brazil are placed at 25 million barrels. But experts believe the nation's potential reserves are several times this figure.

While Brazilian crude production rose last year from less than 200 wells in the Bahia basin to about 2000 barrels daily, more than double the 1950 average and more than 300 times the volume produced in 1940, domestic crude production currently amounts to only 1.88 percent of the domestic demand of more than 110,000 barrels daily. Present consumption is nearly four times that of 1940.

While the solution to increasing domestic production in a higher percentage of consumption would be to embark on a broad exploratory campaign of finding ample sources of oil, the already financially-depressed Vargas regime has said its objective for the Brazilian petroleum industry is to "transform the country from an importer of refined products into an importer of crude oil."

The National Petroleum Council last year commenced a program of refinery construction to realize this goal. The nation continues, however, to have a serious petroleum shortage, and currently is reported approximately $20 million behind on payments for petroleum imports that amount to an annual expenditure of more than $200 million.

The Bank of Brazil recently decided to set aside monthly quotas of its already short dollars for petroleum imports by creating a special exchange priority to ease the critical petroleum shortage.

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1200 Delegates Attend 19th Geological Congress

Dr. Charles Jacob elected president at meeting in Algiers.

By DR. J. BRIAN EBY
Consulting Geologist, Houston

THE NINETEENTH International Geological Congress convened in Algiers September 8 with an enrollment of 1200 delegates representing 77 different countries of the world. Sponsored by the French Government and the University of Algiers the congress was directed by scientists of several countries.

Participation by the Soviet Union, at the last moment, made it a thoroughly international meeting. The Russian delegation, headed by G. Bogomolov, and N. Semenenko, the latter from the Soviet Ukraine, consisted of six scientists and three interpreters.

The official United States delegation, headed by William E. Wrather, director of the U. S. geological survey, was one of the largest groups present. Others attending from the U. S. were Finn E. Bonner, Department of the Army, Corps of Engineers; W. H. Bucher, Columbia University; A. F. Buddington, Princeton University; Edward B. Burwell, Department of the Army, Corps of Engineers; H. G. Ferguson, U. S. Geological Survey, T. S. Lovering, president of the Geological Society of America; W. D. Johnson, Jr., U. S. Geological Survey; Raymond C. Moore, University of Kansas; and W. P. Woodring, U. S. Geological Survey. David Perry Olcott, Houston geologist, headed a delegation from the American Association of Petroleum Geologists. Several unattached American scientists attended, including Dr. R. Semmes, San Antonio; Dr. Frederick K. Morris, professor emeritus of geology, Massachusetts Institute of Technology; Virgil Barnes, Bureau of Economic Geology, Austin, Texas; Olaf Sundt, U. S. State Department, Paris, France.

Geological Surveys of many nations sent directors or representatives. Among them were Louis T. Nel, director, Geological Survey of the Union of South Africa, Pretoria; Demetrio Andres, director and founder of the Philippine Geological Survey, Manila; and Murrogh V. O'Brien, director of the Geological Survey of Ireland, Dublin.

Dr. Charles Jacob of the Academy of Science, the Colonial Academy of Science and honorary professor of geology at the Sorbonne, Paris, was elected president of the Congress and Professor R. L. Lafitte, Faculté des Sciences, Algiers, secretary. The nominations and elections were held in Hall des Actes at the University of Algiers, and each of the 250 seats was equipped with earphones and dials equipped to tune in immediate translations from the speakers' language into English and/or French.

How's that?

The first discordant note of the 19th International Geological Congress at Algiers came when the chief Russian delegate criticized the arrangements committee for failing to provide adequate translating facilities into Russian. Dr. Charles Jacob and Professor R. L. Lafitte, who had just been elected president and secretary respectively, defended the arrangements and won the backing of the delegates.

The official opening of the Congress was held in the auditorium of the Government General, and greetings were extended by M. Jean-Marie Louvel, minister of commerce and agriculture, and M. Roger Leonard, governor general of Algeria. Professor H. Read of England, the retiring president, turned over the gavel to Dr. Jacob and the formal opening functions were complete.

A reception for delegates at the Palace d' Eté, the home of Governor General and Mrs. Leonard, was followed by a formal banquet at the Saint George Hotel.

With more than 250 oil geologists attending, or nearly 20 percent of the membership, the presidents of four oil companies in North Africa entertained all oil delegates with a banquet. The four companies were: the Societé Cherifienne des Petroles, the Societé Nationale de Recherche et d' Exploitation des Petroles en Algerie, the Societé de Recherches et d' Exploitation de Petroles en Tunisie, and the Societé des Petroles d' Aumale.

New Pipe Line in Africa To Be Completed Next Year

The new pipe line under construction for Petrocongo Ltd. from the port of Matadi to Leopoldville will be completed early in 1953. The 6-inch line will be 209 miles in length. The capacity will be increased later by addition of pumping stations. The new line will be reserved for moving gasoline, and the old line, built in 1911-1912, will carry oil. New storage facilities will be erected at Leopoldville.

During 1951, the Congo's petroleum handling facilities at Matadi port dealt with 2 million barrels of petroleum products which went to the colony, to French Equatorial Africa and to Angola. Rate of shipment is still rising.

Until completion of the new line, gasoline will be sent to Leopoldville in rail tank wagons at the rate of about 100,000 barrels monthly.

New Firm May Be Set Up

A new French national exploration company may be formed to continue exploration for oil in the Alsace potash field. The company would be formed by a syndicate which has hitherto conducted explorations and which comprise the Mines Domaniales de Potasse d'Alsace, the Pechelbronne Co., and the Société Nationale des Petroles du Languedoc Mediterranean.

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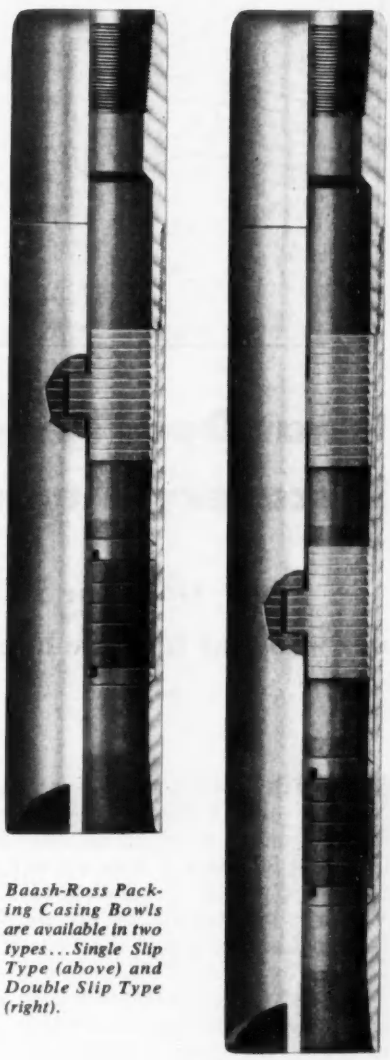

Baash-Ross Packing Casing Bowls are available in two types...Single Slip Type (above) and Double Slip Type (right).

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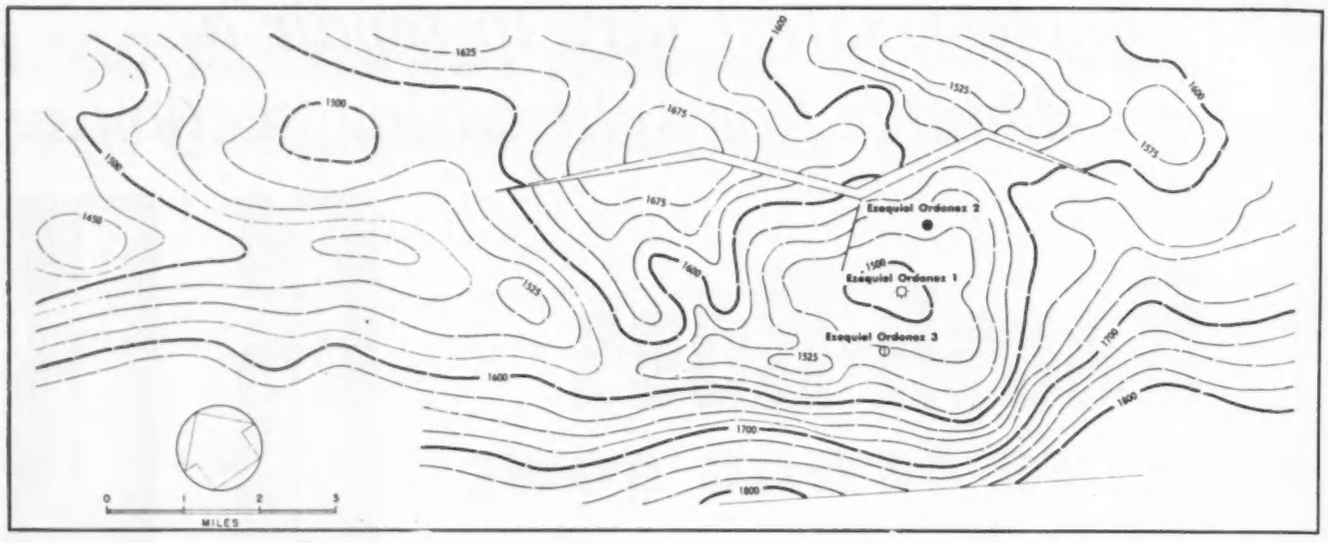


This seismologic sketch of Ezequiel Ordonez field shows a series of heights running northwesterly from field and situated in more favorable structural locations as they move north. This creates possibility that these heights may be potential oil reservoirs.

What Does Pemex' New Discovery Mean?

Good for 5000 barrels a day. Ezequiel Ordonez well may indicate huge reservoir. Here are the facts.

THE 5000-barrel-a-day Ezequiel Ordonez 2, Mexico's most important oil discovery in almost 25 years, is believed to have opened a prolific producing field in Veracruz State, between the old Golden Lane field and the Poza Rica field.

"Initial characteristics and our knowledge of the nature of the structure give us reason to think that it may be one of the largest fields in Mexico," said Senator Antonio J. Bermudez, director general of Petroleos Mexicanos, the government oil agency.

The new discovery, the open flow of which is estimated to range as high as 40,000 to 50,000 barrels daily, is being compared with Cerro Azul, Potrero del Llano, Juan Casiano, and Poza Rica fields. The first three of these were discovered between 1908 and 1916 in the famous Golden Lane —a crescent-shaped chain of fields southwest of Tampico in which were situated individual wells of world-record proportions. Poza Rica field was discovered in 1930, and currently is Mexico's largest producing field.

Ezequiel Ordonez 2 was completed August 17 at 5235 feet. Production was being tested from a 20-foot horizon, between 5211 feet and 5231 feet.

The new Ezequiel Ordonez field is situated 13 miles east of Poza Rica's most easterly installations.

Exploration efforts seeking the trend on which Golden Lane fields are situated has been underway since 1948, with gravity meter and seismologic field parties. Prior to 1948, wildcats had been drilled in the Acontitla and Horcones heights to provide stratigraphic data. The tests showed the type of rock to be found at the programmed depth was similar to the producing limestone corresponding to the Cretaceous, the Golden Lane storage rock.

Exploratory research was carried on toward the southeast and several structural heights were defined at considerable distances from Golden Lane.

In the first of these, about 60 miles southeast of Golden Lane, the Miguel Aleman 1 was drilled in 1949. The well was originally known as Arroyo Grande 1, in which El Abra limestone was found at 6717 feet. Lithologic characteristics of this rock corresponded closely to those already known in the Golden Lane fields.

Permeability of this limestone was extraordinarily great, although it contained salt water and showed traces of heavy hydrocarbons (asphalt).

It was through a velocity survey run on this well that speeds of propagation of the bored strata were learned. Consequently, they furnished more accurate means for interpreting seismologic logs previously run. And that brought about the re-interpretation of all such seismic records. The more thorough coverage of the area culminated in the location of Arroyo Grande 2. This well was drilled early in 1951, and the top of El Abra limestone was found at a depth of 5317 feet. Characteristics of the storage rock in this well were identical to those found in Miguel Aleman 1, yielding a surface flow of salt water which showed slight traces of heavy hydrocarbons.

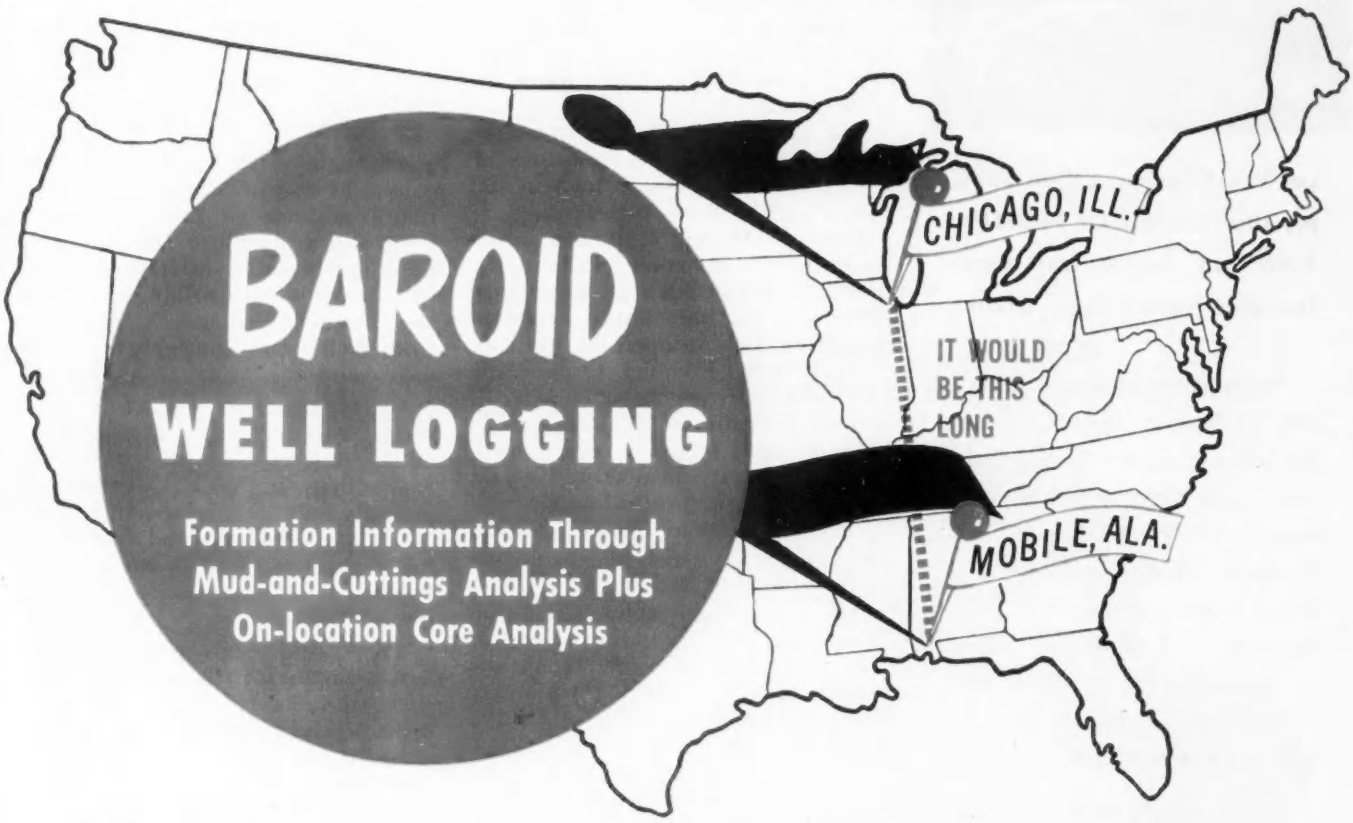
With geologic data from these two wells and those previously drilled in the northern end of the area under survey, geologists again went to work. Consequently, Poza Verde 1 was drilled early in 1952 at a site on the same trend as the previous wells but structurally more favorable.

Results were again likely-looking limestone at 4792 feet with water and slight traces of hydrocarbons.

Belief grew into certainty that at some more favorably located structural positions this Cretaceous limestone would undoubtedly hold oil accumulations. So Tenixtepec 1 was drilled. The well, rechristened Ezequiel Ordonez 1 in memory of a Mexican geologist, reached El Abra limestone at 4592 feet and was completed in June, 1952.

The geologic age of the strata corresponds to the Oligocene down to the Lower Palma Real, to the Eocene down to the top of El Abra and the latter to the Cretaceous. There were

More than 4 million *feet of hole have been successfully logged by...*



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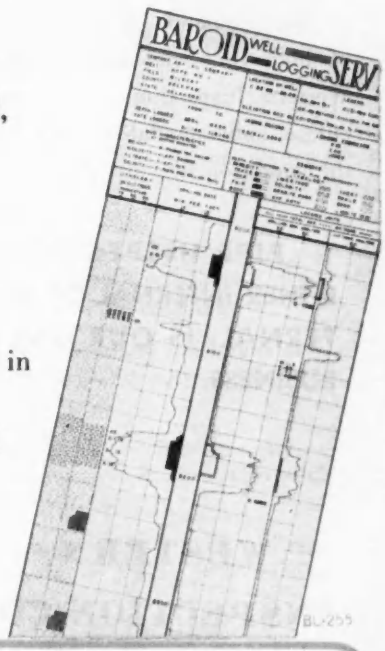

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PIPE INSPECTION

two evident discordances: between the Oligocene and Eocene and between the Lower Chicontepec and El Abra.

A drillstem test was run and gas flowed to the surface. At 4838 feet, 6 5/8-inch casing was cemented, and the well was completed in open hole with 2 7/8-inch tubing and permanent connections.

The well produced 12.8 Mmcf of gas daily, with surface pressures of 1945 pounds per square inch in the tubing and 2158 psi in the casing.

Ezequiel Ordonez 1, situated at the structure's high point, led to the belief that the well was on a structure containing oil but that its position caused the hole to open the gas cap.

By drilling Ezequiel Ordonez 2, 1640 feet from northeast of Well 1, structural conditions prevailing on the seismic height might be determined, considering that this new well would have to be structurally lower—from 82 to 98 feet—than Well 1, thus enhancing the possibility of encountering oil-saturated horizon.

The stratigraphic column found in Well 2 was identical to that of Well 1, and the stratigraphic correlation was perfect. The top of El Abra limestone was reached at 4694 feet, or 102 feet lower than at Well 1.

In a drillstem test, gas flowed immediately, with bottom hole pressures identical with those recorded at Well 1, thus tending to show that Well 2 was still in the gas cap.

Six and five-eighths-inch casing was cemented at 5097 feet, and it was decided to continue drilling a 5⅝-inch hole down to 5236 feet. The storage limestone was found oil-impregnated beginning at 5166 feet subrotary level.

After running electric logs, a 4½-inch liner was cemented from 5028 feet. A squeeze job was performed until cement-injection pressures of 2982 psi were attained. The liner was jet-perforated between 5210 and 5230 feet, with 36 half-inch perforations. Two and seven-eighths-inch tubing was run, and, after two acid treatments of 500 and 1000 gallons, the well yielded 6200 barrels a day through a 13/16-inch choke.

Bottom-hole pressures under shut-in and flowing conditions, as well as bottom-hole pressure increase were checked. Shut-in bottom hole pressure reached 2366 psi. In the open well, flowing through a 9/16-inch choke, bottom hole pressure was 2340 psi, with a production of 4200 barrels daily and surface pressures of 589 psi on the tubing and 710 psi on the casing. That means the productivity index determined as the volume for unitary abatement of bottom-hole pressure is 2300 barrels per 14.2 psi.

Time elapsed to restore bottom-hole pressure under shut-in conditions was three minutes; the gas-oil ratio, measured under flowing conditions, was 50, thus leading to the belief that dynamic conditions prevailing in the structure are identical to those existing in Golden Lane fields. Therefore, it is believed that the available energy in the new reservoir will be completely hydraulic.

Through Well 2 a definite idea was gained as to hydrocarbon accumulation conditions on the northeastern flank of the structure. To determine these structural conditions on the southwestern flank, drilling was begun on Ekequiel Ordonez 3, 1115 feet from Well 1 on a southerly 59 degree west course.

In the new hole, top of El Abra formation was reached at a depth of 4605 feet, or 13 feet structurally lower than in Well 1, which apparently indicates the structure levels out toward the west and that it will bring about a more pronounced development of the producing limestone.

The stratigraphic column of Well 3 was similar to those found in the previous wells. However, Well 3 was drilled until water-oil contact was actually determined — to 5117 feet with the 8 5/8-inch hole, equivalent on a subsea level basis to that reached in Poza Verde 1, found invaded by salt water. Nine and five-eighths-inch casing was cemented at 1135 feet.

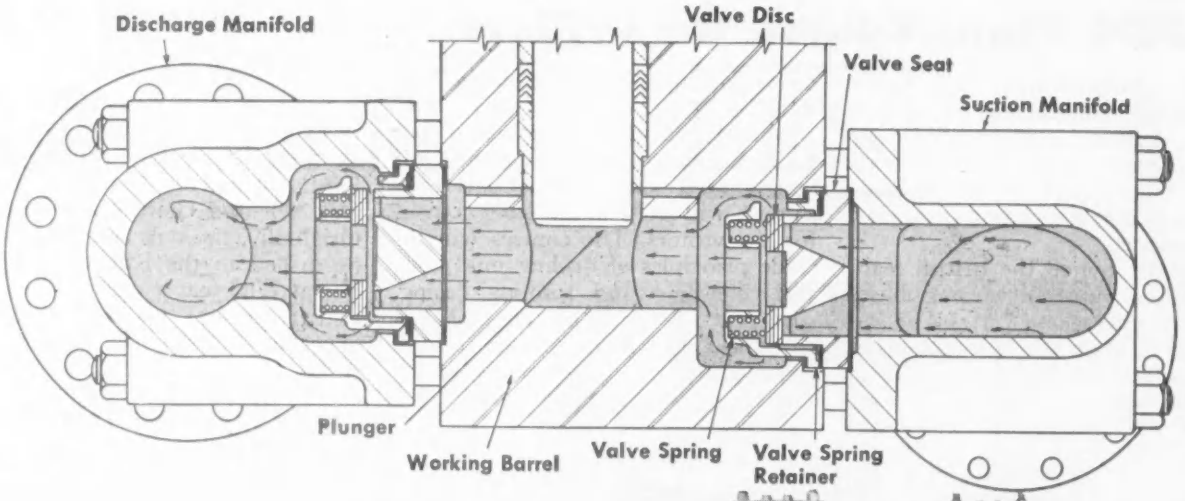
Electric logs were run, and 6 5/8-inch casing cemented at 5097 feet. Temperature and radioactive logs indicated a variation in permeability starting down from the 4979-foot subrotary level with the limestone occurring in alternate strata, permeable and dense, but without enabling the detection from such logs of the presence of salt water.

To determine salt water-oil contact, Well 3 was jet perforated from 5061 to 5068 feet, and a production test now is underway.

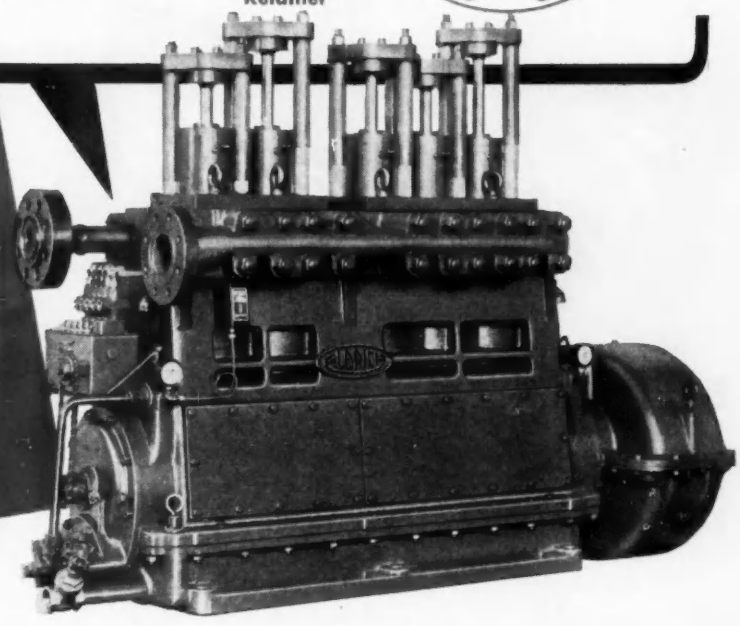
Discovery of the Ezequiel Ordonez structure is of paramount importance to Pemex because of the possibility of a large crude resevoir.

Senator Bermudez credits three men with the new discovery: Manuel Rodriguez Aguilar, director of exploration; Alfonso Barnetche, in charge of drilling; and Santos Figueroa Huerta, head of geophysical operations.

A provisionally laid 10-inch, 15.6-mile pipe line will move Ezequiel Ordonez crude to Poza Rica installations. Within two months, oil from this new field will be wholly incorporated into Pemex production.



ENGINEERS: Check these points of Aldrich Direct Flow Design



Aldrich engineers eliminated two right-angle turns in the fluid-end. Now, liquid passes from suction to discharge manifold in a *straight line.* That gave the Direct Flow Pump its name, and set up a whole new concept of pumps, pumping, and pump maintenance. It all adds up as follows:

☐ **Increased operating speeds**—you get whatever volume and pressure you need *from a smaller, lighter, more compact pump.*

☐ **Sectionalized construction**—parts can be replaced at a fraction of the cost of a new fluid-end; also, parts can be made of stainless, bronze, Monel or other special materials—extremely important for corrosive fluid service.

☐ **Maintenance made easier**—no more tapered bores in the working barrel. Manifolds are *not* taken off but slide out on studs—affording room to *lift out* valves as complete units. Packing is easily renewed—note accessibility of stuffing boxes.

☐ **Interchangeable wearing parts**—available among 3, 5, 7 and 9 plunger pumps of same stroke size. This minimizes spare parts costs and inventories.

☐ **Changeable plunger sizes**—in many cases it is only necessary to add new plungers, glands, throat bushings and packing *to the same fluid-end.*

☐ **Drive direct**—by connection to synchronous engine type motor or internal combustion engine; also with integral speed reducer or V-belts.

Contact your Aldrich Representative . . . or write to us direct for complete details on 3", 5" or 6" stroke units.

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AAODC Plans Course for Drillers

Twelve Anglo-Iranian Oil Company drillers will visit the U. S. on a training program made available by the American Association of Oilwell Drilling Contractors, A. W. Thompson of Houston, association president, has announced.

"We have invited the British team for refresher courses on various phases of drilling operations," Mr. Thompson said. "Upon the completion of these studies, the drillers have been invited to join AAODC contractors' crews for further field training," he said.

John Woodruff, coordinator of petroleum industry training at the University of Texas and AAODC consultant, will assist in mapping courses for the visitors. The courses will include principles of drilling mud control, handling and running casing, care and operation of pumping engines and units, care and use of wire ropes, drilling industry safety clinic, and supervisory training course.

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By reversing normal circulation to literally pull objects into the basket, the BOWEN JUNK BASKET assures complete single-run recovery of all bottom hole junk.

Circulating fluid is diverted through side passages in the barrel and against the full circumference of the hole. Here the fluid is deflected, moving all objects toward center. Fluid flows in a continuous stream to the center of the tool and up through the barrel to return ports pulling all objects through the catcher. This reverse circulation action assures more complete recovery of junk in the hole and eliminates misruns. *Full pump pressure can be utilized* because there's no danger of pressure bearing against and causing loss of the fish.

Comes in sizes from 3¾" to 17½" and is engineered to recover all types of bit cones used to drill hole sizes within its range.

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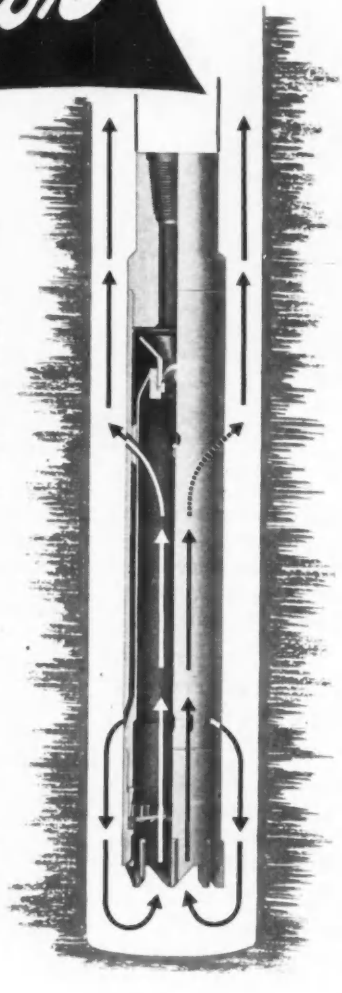

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New Suderbruch Field Well Strikes Oil at 7642 Feet

Suderbruch 48 has struck oil in the Posidonia shale horizon of Lias epsilon at 7642 feet. Suderbruch field is jointly owned by Deutsche Vacuum Oel AG. and Gewerkschaft Brigitta. Originally, the hole was scheduled to be drilled to the Rhaetic sandstone, but at 7783 feet a violent oil and gas eruption was encountered and checked. An extremely high gas pressure was encountered which was kept under control.

With a gravity of 0.839, the crude is one of the lightest hitherto found in Germany.

German Wildcat Finds Gas At 5900 Near Hanover

Gewerkschaft Brigitta and Gewerkschaft Deutz have completed a wildcat at 8812 feet at Grossburgwedel, near Hanover, Germany. After sandstones of the Upper Dogger, between 5839 feet and 5908 feet, were perforated, the well yielded about 21,000 cubic feet of wet gas hourly. Extent of the gas horizon and possible connection with an oil deposit have not been reported.

Swiss Basin Bids Mount

Indications of oil and gas in Switzerland's Molasse basin have led to preparations for drilling, and about a dozen firms are seeking concessions. As a result of mounting applications, national and cantonal authorities have agreed not to grant individual concessions but to cooperate on the question of issuing concessions.

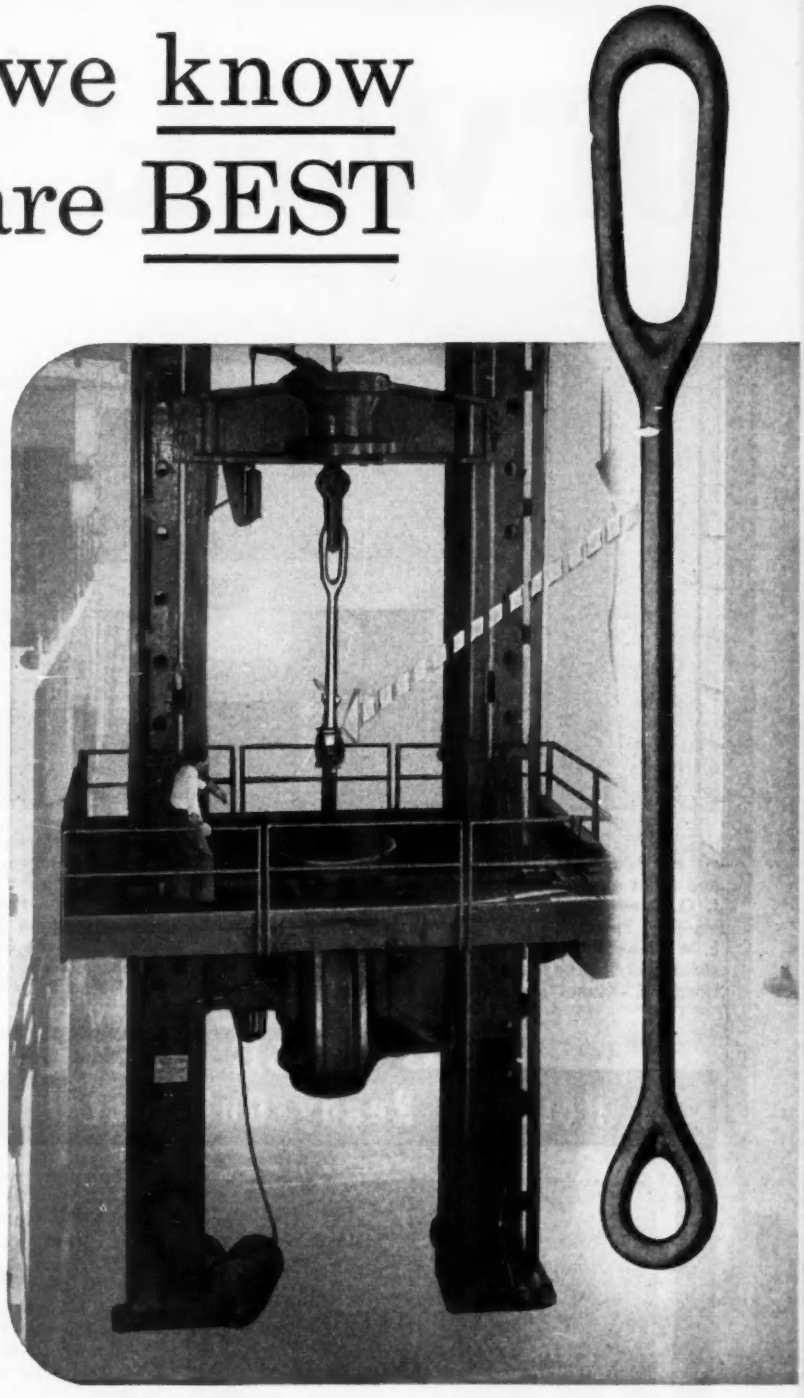
Price Gouge Claimed

All storage facilities in countries with which Russia trades are filled with Albanian oil, according to a report from Yugoslavia, while excess prices are demanded from Albanians' purchases of refined products for domestic use. The report says that the price for 2.2 pounds of crude equals the cost of 4.4 pounds of wheat.

French Production Up

Total French crude output in June reached 208,882 barrels, bringing the total for the first six months of 1952 to 1,203,349 barrels. In the first half of 1951, 913,255 barrels were produced.

Here's why we know these links are BEST



Only a test to destruction justifies the recommended load capacity and assignment of the 4 to 1 safety factor for Web Wilson FORGED Elevator Links. Links of each shank diameter, taken at random from stock, are *tested to destruction* on the Baldwin-Southwark Testing Machine (at right) which is capable of exerting a force of 4,000,000 pounds.

Here is scientific proof that these links are BEST, but let us consider the factors which result in such superiority . . .

Starting with engineering calculations which insure adequate steel at points of stress —made from steel better suited to the requirements, and higher in cost than is used in other makes of links—Web Wilson FORGED Elevator Links are the *only drop forged* links available today; welding is entirely eliminated.

Next follows heat treating to exacting standards in modern *vertical* furnaces to avoid warping or distortion—then each link is carefully "Magnafluxed" to assure uniform quality and freedom from *any* imperfections.

That's why we *know* that Web Wilson FORGED Elevator Links are BEST—that's why we can proudly say "They are the strongest 'link' in your drilling string."

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Shank Diameter INCHES	*Rated Capacity TONS PER LINK*	
1¾	65	*Lengths from*
2¼	110	*36 inches to*
2¾	150	***108 inches***

Tops in the field, WEB WILSON *Forged* ELEVATOR LINKS *today* provide ***extra strength, extra safety and extra value*** for heavy duty service and severe usage.

IF YOU WANT TO "GET TECHNICAL"

Web Wilson FORGED Elevator Links are made from SAE 4140H steel which is considerably harder and more expensive to forge and heat treat than the steel used in other makes of links. You will find it worth while to refer to the chemical analysis of SAE 4140H steel, which is as follows: Carbon, .35 to .45; Manganese, .70 to 1.05; Chromium, .80 to 1.10; and Molybdenum, .15 to .25. Hardenability of SAE 4140H steel runs from 39 to 55. With a Brinell hardness of 350, the tensile strength is approximately 200,000 psi for SAE 4140H steel. Higher tensile strength; greater resistance to shock; higher toughness resulting in better resistance to wear—all vital factors in an elevator link—amply justify your approval and specification of Web Wilson Links over competitive makes.

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Of World Oil Men

INTERNATIONAL GUESTS at the September meeting of the Los Angeles Chapter of Nomads are pictured from left to right, standing, back: A. E. Giles of Standard Vacuum from Sumatra; Bud Miles of International Petroleum from Colombia; W. C. Lance of Iraq Petroleum from Iraq; J. O. Donovan, also of Iraq Petroleum; Arthur R. Phillips of Australasian Petroleum from Port Moresby, Papua; Larry D. Cannon of Drilling & Exploration, foreign division. Standing forward: E. W. Conn of R. M. Parsons Company from India; John L. Everett of Mene Grande from Venezuela. Seated: Carlos Osorio, Consul of Chile; Herbert E. Allred of Socony-Vacuum from Venezuela; Harold G. Karnes of Iraq Petroleum from Mosul; L. E. Miles of Iraq Petroleum from Kirkuk.

CASE HISTORIES
of Houston Ready-Cut Installations

Oil Company Housing In West Texas — These attractive five-room cottages near Crane, Texas, are part of the 37 houses built for a major oil company in 1948. A total of 6 five-room and 31 four-room units were furnished and erected at locations throughout West Texas by Houston Ready-Cut crews. These are but a few of the thousands of Houston Ready-Cut homes that are providing good housing for oil industry personnel at home and abroad.

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S. P. KENT, formerly acting assistant manager of Texas Petroleum Company in Bogota, Colombia, has been transferred to Edmonton, Canada, where he is drilling and production superintendent of Texaco Exploration Company. Kent has been with Texas and subsidiaries since 1934. Born in Havana, Cuba, he received a degree in petroleum engineering from Louisiana State University in 1934. He has worked in South America from 1946 until his recent transfer to Canada.

•

R. O. MITCHELL has been appointed assistant division geologist for the Canadian Division of Stanolind Oil and Gas Company. Mitchell has been with the Canadian Division since October, 1950, working first as senior geologist, and later as division geophysical coordinator. He first went to work for Stanolind in 1941 as a geological scout in Kansas. He later served in Oklahoma, the Rocky Mountain area, southeastern United States, Arizona and New Mexico. Mitchell attended both Phillips University, Enid, Okla., and the University of Oklahoma. He was graduated from Oklahoma in 1940 with a B.S. degree in geology.

•

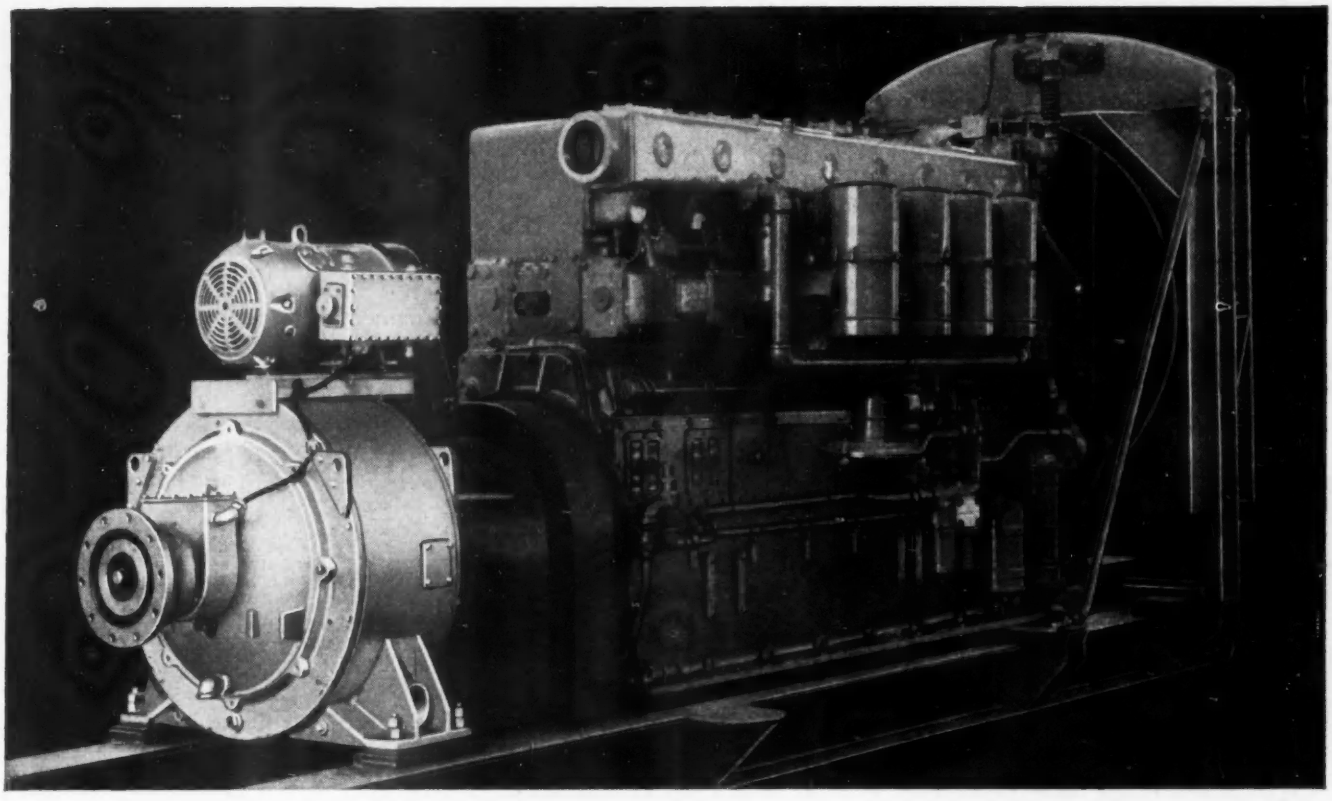
DISQUE DEANE of New York City and BRIG. COLIN CAMPBELL, D.S.O., O.B.E., of Toronto, have been elected directors of a new company, Canadian Decalta Gas and Oils Limited, formed from Decalta Oils Ltd., Toronto.

•

G. P. CROMBIE has been named chief geologist and R. P. GALBRAITH chief land man of Texaco Exploration Company. A native of Edmonton, Alta., Crombie was with the Canadian Department of Mines and Resources (Geological Survey) at Ottawa prior to joining Texaco Exploration in 1948. Galbraith, a native of Guelph, Ont., joined the company in 1949, prior to which time he was associated with the law firm of Porter, Allen and Millard in Calgary.

•

THOMAS BURNHAM, Creole Petroleum Corporation civil engineer in the Caracas office, has been transferred to the Caripito division in Eastern Venezuela.



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HAROLD W. HAIGHT, executive vice president and a director of Creole Petroleum Corporation, was awarded a distinguished achievement medal by the Colorado School of Mines at its 1952 commencement exercises. Haight was graduated from the school in 1927 with a degree in geological engineering. He has been associated with Standard Oil Company (New Jersey) and affiliated companies since his graduation.

•

EUGENE L. DAVIS has joined the National Petroleum Corporation Limited, Calgary, Alta., as projects manager. He has been project manager for Arctic Contractors in developing the U. S. Navy Petroleum Reserve 4 for the past three years. Prior to that, he was production superintendent for Signal Oil and Gas Company in California. During World War II, Davis was director of production for the Petroleum Administration for War in District 4, which included California and the West Coast.

•

JOHN R. SUMAN, vice president and director of Standard Oil Company (New Jersey), was the subject of a biographical sketch in a recent issue of *Washington Report*, published by the U. S. Chamber of Commerce. The article was one of a series on chamber directors, Suman being a director at large in the national chamber. Suman was described as having "responsibility for Jersey Standard's production in North and South America, Europe, Africa and Asia."

•

JOSEPH H. ELLENDER has been named chief economist by Arabian American Oil Company. Prior to joining Aramco, Ellender was assistant manager of the economics department of The Texas Company, a position he accepted after wartime service with the Petroleum Administration for War. Active in industry-wide problems, Ellender served as a member of the Statistic Advisory Committee of the American Petroleum Institute and has assisted in other activities of the institute. He was also a member of the Economics Advisory Committee of the Interstate Oil Compact Commission and the Subcommittee on Demands of the Military Petroleum Advisory Board.

Ellender

•

GEORGE A. GUMBS, JR., has been elected to the board of directors of Esso Shipping Company. He succeeds JOHN J. WINTERBOTTOM, who recently was named worldwide transportation coordinator for Standard Oil Company (N. J.). While serving on the board, Gumbs will continue in his present position as manager of the Traffic division. Gumbs began his career in the Foreign Shipping department of Jersey Standard nearly 35 years ago as an office boy, and after completing special training courses in petroleum production, refining and marketing he joined the traffic division in 1922. He served as assistant section chief, section chief and assistant manager before becoming head of the division in 1945.

•

CHARLES RALPH THOMSON has been appointed superintendent of operations in Canada for Sohio Petroleum Company. Thomson graduated from the University of Oklahoma in petroleum engineering, and has had many years' experience in drilling and operating in Western Canada. Prior to joining Sohio, he was Socony-Vacuum Exploration Company's petroleum engineer in the far north.

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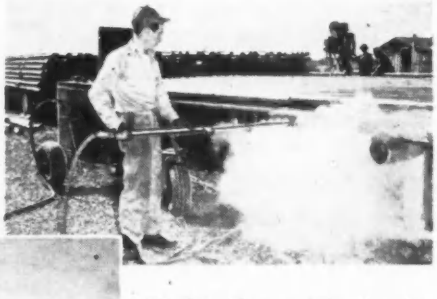

(*Right*) All pipe returned to our yards is steam cleaned and rigidly inspected.

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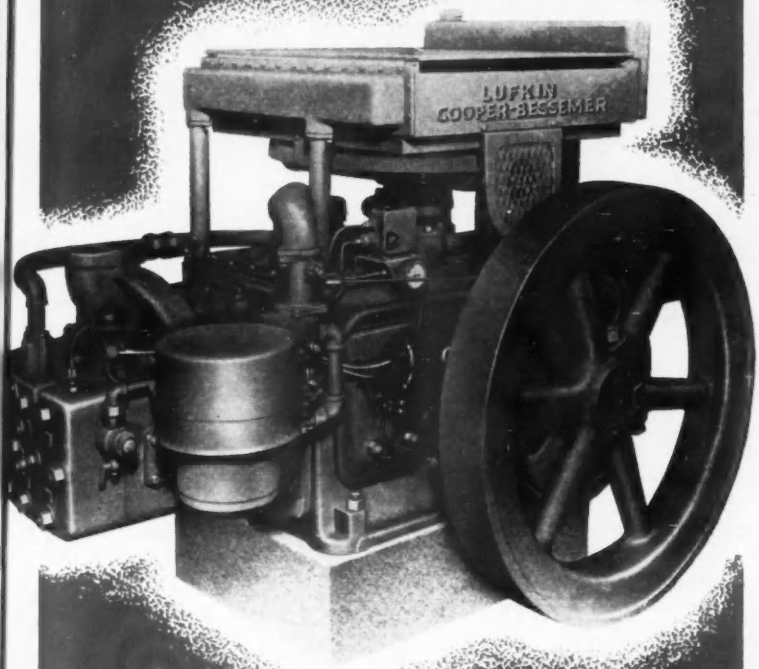

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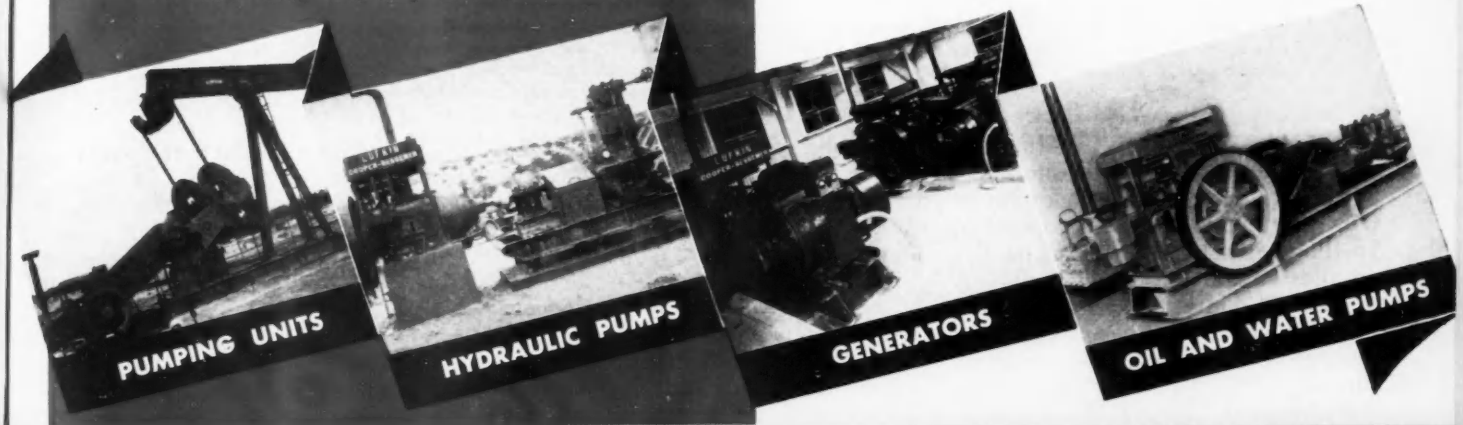

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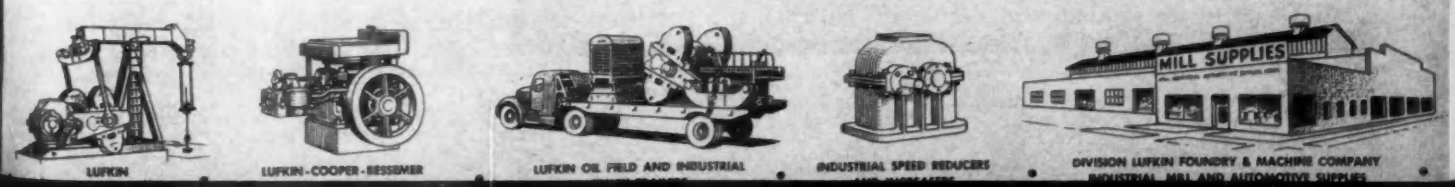

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Left to right are: Joe Cozby, business manager of Odessa Chuck Wagon Gang; Houston Crump, Permian Basin Oil Show manager; E. G. Rodman, honorary president of the show, and J. A. McVean, Chuck Wagon boss.

These officials are all smiles! With 320 exhibitors to show products of 600 manufacturers, they're looking toward . . .

Biggest Permian Basin Show Yet

A GALA welcome is awaiting the more than 100,000 visitors expected at the second Permian Basin Oil Show in Odessa, Texas, October 16-19. The show will be held on the grounds and in the exhibit buildings of Ector County Park and 320 exhibitors will show the products or services of more than 600 manufacturers.

Nicknamed "The Oil Field Workers' Show," the exposition will include entertainment features as well as a wide variety of different types of equipment.

Kickoff event will be a downtown street parade in which a record number and assortment of oil field rolling stock will be mixed colorfully with bands, floats and mounted groups.

Admission to the grounds and the five exhibit buildings will be free to the public each day of the four-day show. Tickets will be sold only for the professional entertainment, dances and the big Saturday afternoon barbecue.

Featured at dances each evening of the show will be the orchestras of Will Osborne and Leo Pieper. The original Bumpstead Family of Hollywood will be on hand as a featured attraction in the afternoon and evening variety show performances.

Lloyd French, French Tool and Supply Company, Odessa and Midland, is president of the board of directors of the show which is a nonprofit organization representing cities and towns all over the Permian Basin. Early Spiars, Spiars Equipment Company, Midland, is first vice chairman; W. D. Lane, Plymouth Oil Company, Midland, second vice president, and Roy Carter, Carter Foundation Production Company, Kermit, treasurer.

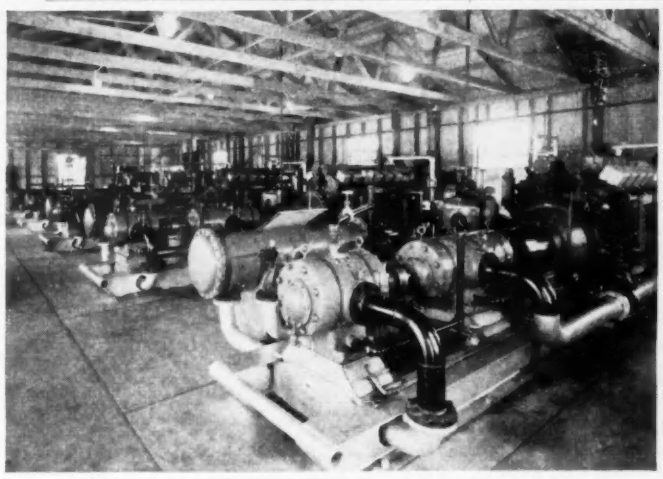
Honorary president of the show is E. G. Rodman, Rodman Supply Company, Odessa. Chairman of ticket sales is Lane who has worked with committee members in oil centers all over West Texas and New Mexico in the sale of ticket books.

The Permian Basin Oil Show is a rejuvenation and enlargement of the Little International Oil Shows held in Odessa in 1940 and 1941. The 1950 exposition attracted 208 exhibitors representing 500 manufacturers in 18 states. They showed their products, services and friendliness to about 70,000 persons.

The purpose of the oil show is to provide for the exchange of information useful to individuals or firms engaged in the production of oil and gas, or in refining and processing

On the plains of Texas
In the hills of Pennsylvania

FULLER ROTARY COMPRESSORS

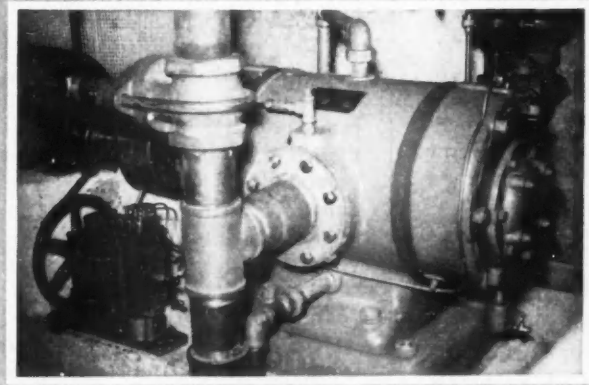


Fuller Rotary Compressors, in the refinery for general plant air, purging gas, refrigeration in alkalization units, and handling butane-butylene, as well as in the field for pressure boosting and gas gathering, have proved their worth, as is evidenced by the many machines in daily use in practically every oil-producing section of the country.

The ability of Fuller Rotaries to perform, day in and day out, with minimum attention, supervision, and maintenance, has *earned* for them a well deserved position in the oil fields. Particularly adapted to handling of weak wells, and the volume demanded, without creating a serious maintenance and supervision problem, they have proved to be an economic and practical answer for many producers.

Simplicity of construction has proved to be one of the important factors . . . the only moving parts being the rotor, bearings, blades. No valves to leak; no seats to grind, *giving full boosting capacity for the life of the machine.* A simplified direct drive eliminates power transmission losses.

Fuller Rotary Compressors are available in a range of cylinder combinations up to 3300 c.f.m. (at atmospheric intake) at normal speeds, with a reasonable variation in speed range—motor, engine or turbine drive.



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Write for Bulletin C-6

C-227

Fuller PIONEERS OF HIGH-EFFICIENCY VANE-TYPE ROTARY COMPRESSORS

thereof, and to provide the manufacturers or distributors of equipment used therein, or firms providing specialized services to the oil and gas industry, an opportunity to exhibit their products or advertise their services.

The show is designed to provide the man in the field with an opportunity to see the equipment or examine the services he uses or may care to use.

Working with the policy-marking board of directors is the Oil Activities Committee of the Odessa Chamber of Commerce. Headed by Robert Durrett, Norvell-Wilder Supply Company, this 50-man committee handles exhibits, parades, entertainment, publicity, police protection and a host of other details.

Slated in conjunction with the Oil Show will be meetings of several oil men's organizations including the American Petroleum Institute. The Permian Basin Chapter of API, largest in the nation, will hold its annual membership and entertainment session here on the opening night of the show, October 16.

Plenty of parking space will be available for visitors at the Second Annual Permian Basin Oil Show. This aerial photo shows the grounds in the Ector County Park before addition of two new exhibit structures. Outdoor booths are in area to right of exposition buildings in center of photo and above the auditorium in the foreground.

Other Meetings

Other organizations expected to meet during the show are the American Association of Oilwell Drilling Contractors, American Institute of Mining and Metallurgical Engineers and National Association of Corrosion Engineers.

Plans are being made to serve western barbecue to more than 15,000 persons on the Saturday afternoon of the show. The Odessa Chuck Wagon Gang, which served 10,000 at the 1950 show, will handle the job.

A special feature of the barbecue will be the 4500-gallon bean pot being designed and built by Sandy Kroeker, Sivalls Tanks, Inc., Odessa. The welded steel pot, conservatively designated by oil show publicists as the largest bean pot in the history of the world, will have a capacity of about 29,000 No. 2 cans of beans.

A smaller pot, built by Kroeker for the last show, is now being used to store crude oil in the field.

The show dates were picked to coincide with National Oil Progress Week, October 12 through 18. Oil Progress Week is the period set aside each year when the men and women of America's 34,000 competing oil companies report to the people about their success under a free economy and the resulting benefits to the consuming public.

A feature of the exhibits will be the Oil Industry Information Committee theater, lounge and information booth. Members of the Desk and Derrick Club of Odessa, oil women's organization, will serve as hostesses at the theater and will distribute literature to the public. The theater will feature the moving picture, "Crossroads, USA," the national sound and color production put out by the OIIC for 1952.

Tired show visitors will be welcome to use the theater as a lounge between performances. There will be no admission charge. The OIIC is financed by the American Petroleum Institute and serves as the public relations end of the API. Ector County chairman of the OIIC and Oil Progress Week is E. W. Showen, Gulf Oil Corporation, Odessa.

Chairman of the movie arrangements committee for the Oil Show is William A. Hopwood, Tnemec Company, Inc., Odessa.

The Oil Show parade, the movies at the show grounds, a special edition of the Odessa American and the show barbecue are expected to be the largest operations of their types in the nation during Oil Progress Week.

In addition to the OIIC theater, a number of the exhibitors are expected to have an oil progress theme in their booths or literature.

Living Library

Histories told by the history-makers themselves will be preserved on tape at the University of Texas library.

Mrs. Walter B. Sharp, widow of an early-day Texas oilman, and her son, Dudley C. Sharp, president of Mission Manufacturing Company, Houston, have established funds for the research project.

Local historians in Texas oil areas will help in tape-recording the stories, told by living pioneers of oil themselves.

"This type of oral history will make possible the preservation of the flavor and color of the oil industry as it was not possible to preserve the experiences and personalities of pioneers in other fields," Professor William A. Owens of Columbia University, who will assist in the project, said.

In addition to the recordings, letters, diaries, photographs and other documents pertaining to development of the Texas oil industry will be preserved, and a series of oil pioneers' biographies will be published as they are completed.

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IPE spreads out. Arrow points to additional space secured for the International Petroleum Exposition in Tulsa. More space is being sought to north of grounds, on the left of photo.. This picture was made during 1948 show.

The task of finding exhibit space for the large number of exposition exhibitors has fallen to Wm. B. Way, general manager.

IPE Is Enlarging Grounds for 1953

Added exhibit space being sought to accommodate overwhelming demands for exposition facilities.

ADDITIONAL exhibit space is being sought the second time to accommodate the overwhelming number of demands for exhibit facilities at the 1953 International Petroleum Exposition, according to Wm. B. Way, general manager.

One new exhibit section, providing 35,000 square feet of space was secured earlier, Way pointed out, but inquiries and requests have been received in sufficient numbers to justify the new search for space.

He said there will probably be between 150 and 250 more oil equipment and service firms with contracts for space at the May 14-23, 1953 show than for any previous exposition.

According to Way, 574 space contracts were issued at the last show in 1948, representing more than 1000 companies. A total of 628 space con-

Plans to honor the "old-timers" who pioneered the oil industry have already begun. Here W. J. Sheery, independent oil man and chairman of the "old-timers" committee for 1953 exposition at Tulsa (left) meets with L. B. Jackson, Jr., son of first president of exposition at replica of Drake well on exposition grounds which will be renovated and made into clubhouse for "old-timers."

They're pointing to . . .

C. F. Brook, grounds superintendent, shows progress being made on the exposition grounds to Frank J. Hinderliter, IPE vice president, right, and D. A. Bridentha, exposition office manager, left.

tracts have already been signed for the forthcoming show.

The housing committee, headed by Barton A. Myers, reports that over 750 houses, ranging from two to five bedrooms, have been listed for rent during the show, and companies have already begun leasing them.

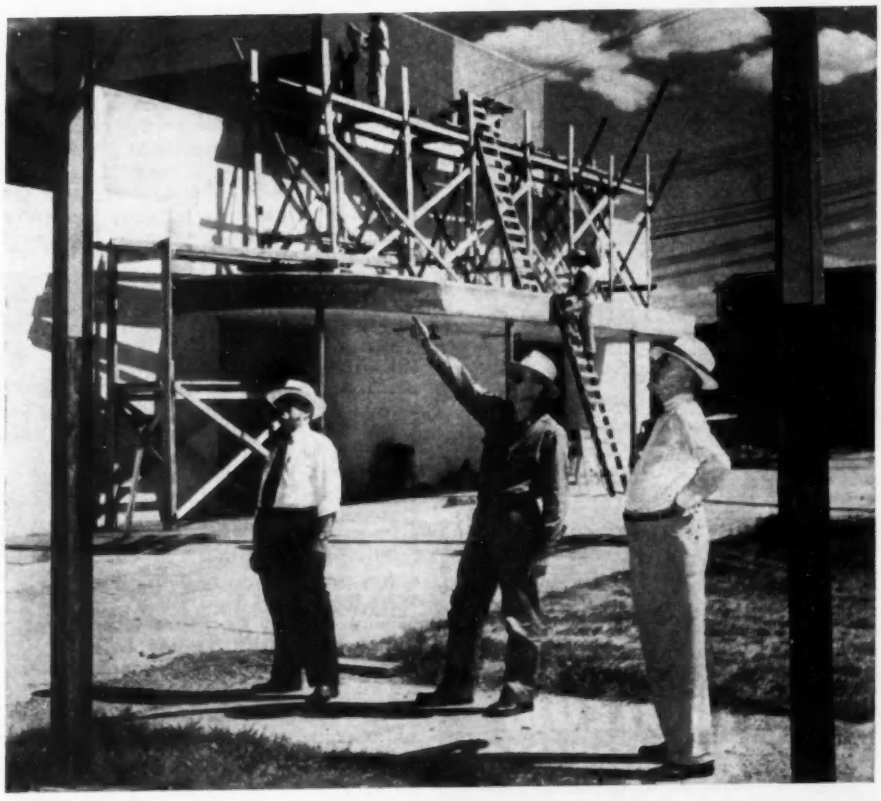
Requests for houses and hotel rooms are still being accepted at the IPE Housing Bureau, 616 South Boston, Tulsa. According to Myers, rent forms, with an insurance provision, are now available.

Over $50,000 worth of leather-upholstered chrome furniture has been purchased and stored by the exposition for rental to exhibitors.

Two-thirds of the $100,000 renovation program work on IPE grounds has been completed, according to Way, and installation of sewer, water, and electric lines in the first additional exhibit area is completed.

"The exposition management is doing all in its power to provide all the exhibit space needed and we hope those unable to obtain space thus far will bear with us until we can create suitable space," Way said.

"All legitimate firms will be able to get space before the show opens," he concluded.



. . . Another successful show

And there's plenty to see. Here Grounds Superintendent Brook is showing Hinderliter, left, and Wm. B. Way, right, where new heavy voltage electric power poles are being installed to care for increasing number of exhibits. In the background, workmen are renovating and repairing the Technical building.

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Men in the Industry NEWS

Lafayette B. Herring has been elected vice president and director of Trans-Tex Production Company, Trans-Tex Transmission Company and David C. Bintliff & Company, Inc. A Houston geologist and oil and gas financier, Herring has been vice president of The Second National Bank of Houston in charge of the Oil and Gas Division since 1946. He is credited with developing that department into an outstanding oil and gas lending department for the South. From 1923 until 1935 when he opened an independent consulting service, Herring was associated with Marlin Oil Company and McElreath & Suggett, oil operators in Fort Worth, Texas.

•

M. A. Wright has been elected executive vice president and director of The Carter Oil Company. Wright, who began his career as a roustabout in Oklahoma oil fields, now is serving as executive vice president of International Petroleum Company. He assumed his new duties in Tulsa, October 1.

A civil engineering graduate of Oklahoma A. & M. College, Wright rose from roustabout to division engineer to chief engineer, and in 1944 was made assistant manager of production for Carter. In 1946 he was named executive assistant in the producing coordination department of Standard Oil Company (N. J.), and became deputy coordinator of world-wide producing activities in 1949.

•

Byron Meredith, a partner of Meredith, Clegg & Hunt, Houston, has resigned from the firm. His interests were purchased by his associates and the contracting firm will continue to do business under the original name. Meredith is at present on a trip through the northwest and will visit Quebec and the eastern provinces of Canada.

•

Hugh B. Downing, formerly secretary-treasurer of Iverson Supply Company, Tulsa, has acquired interest in Johnn Drilling Company, Fort Worth, Texas, and is now secretary-treasurer for that company. Before his association with Iverson Supply Company, Downing was connected with Oil Well Supply Company and Continental Supply Company. Johnn Drilling Company operates rotary rigs in West Texas and New Mexico. **Johney Cockburn** is president of the company with **Vernon E. Blain,** vice president and drilling superintendent.

Hugh B. Downing

•

Eugene Holman, president of Standard Oil Company (N. J.) has been named recipient of the first annual State Fair of Texas' "Texan of Distinction" award. He will speak at the State Fair annual banquet, October 7, when the award will be presented. The award will be made each year to a native-born Texan who has lived at least 15 years in Texas and who has distinguished himself in industry, science or the arts on a national scale.

Kenneth H. Shaffer, formerly assistant general manager of Standard Oil Company of California's Producing department, was recently appointed a vice president and director of The California Company. Succeeding Shaffer in the Producing department is **C. W. Gibbs,** since 1950 manager of the department's Northern California district. **W. A. Eardley,** previously chief petroleum engineer, took over Gibbs' former post in Taft, Calif.

Kenneth H. Shaffer

Shaffer, a graduate of the University of California, joined Standard in 1929, and has served in the Producing, Industrial Relations and Personnel departments, and the Department on Organization.

Gibbs graduated from Stanford University and in 1922 joined Pacific Oil Company, a firm later acquired by Standard. Since 1927 he has been in the Producing department.

Eardley joined Standard in 1926, a year following his graduation from Stanford, as a petroleum engineer.

•

Glenn E. Nielson, Cody, Wyo., has been elected to the board of directors of Northern Natural Gas Company. Nielson is president of the Husky Oil Company and of Husky Oil and Refining, Ltd., in Canada, and is chairman of the board of Gate City Steel Works Inc., Omaha. He has twice served as president of the Rocky Mountain Oil and Gas Association, and is a member of the National Petroleum Council.

•

George L. Robinson has been elected vice president of the Buckeye Pipe Line Company and will continue to make his headquarters at Allentown, Penn. Formerly manager of the Eastern Products division, he will now be in charge of the new Eastern Products Pipe Line System. A staff member since 1932, he formerly served as general superintendent of the company's lines throughout Indiana, Illinois, Michigan and Ohio.

•

N. E. Woolf, division machinist for Service Pipe Line Company, was promoted to area master mechanic and will assist **F. M. Willenburg,** East Texas division manager, in the installation and maintenance of pumping equipment. Woolf, born in Bowie, Texas, served as city engineer five years before joining Service Pipe Line Company in 1926. He will make his headquarters in Fort Worth.

•

John W. Gendron has been appointed manager of the Crude and Products department of the Western Division of Tide Water Associated Oil Company, with headquarters in San Francisco. A graduate of the University of Oregon, he also studied law at Georgetown University and the University of San Francisco. He joined Tide Water Associated in 1946.

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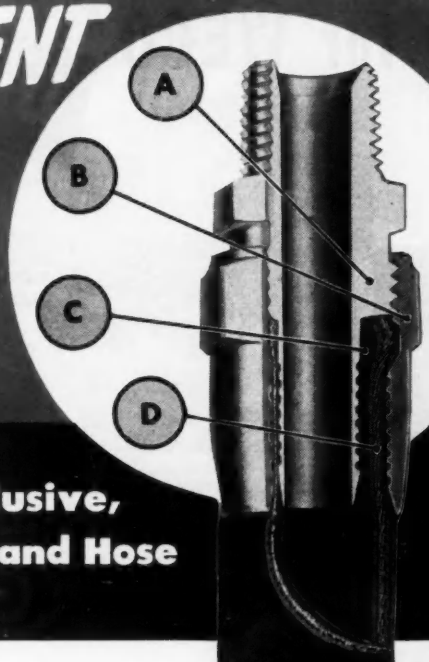

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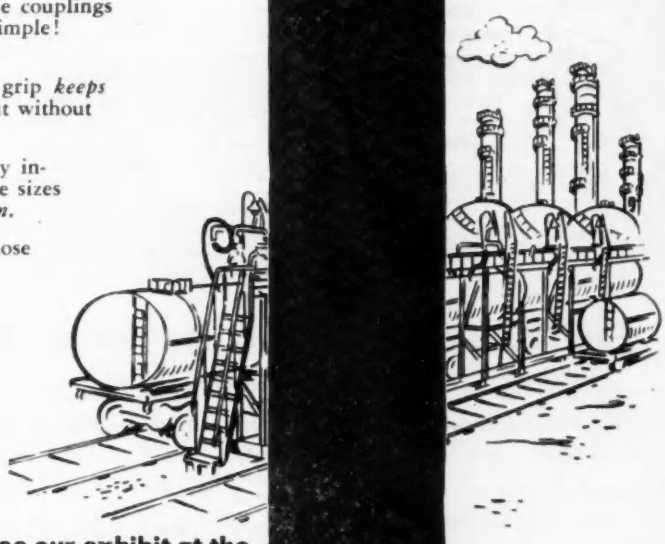

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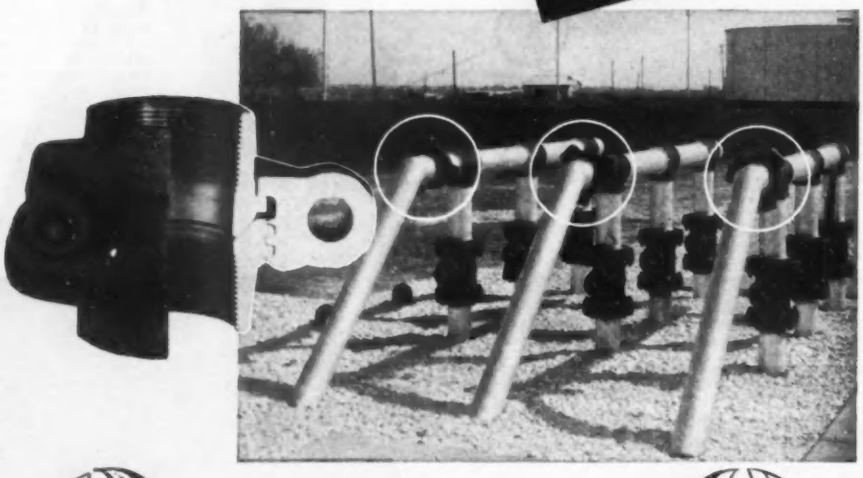

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Henry L. Stine, assistant treasurer and assistant secretary of Sunray Oil Corporation, has been named manager of the company's general office accounting department at Tulsa. Until recently Stine had been manager of Sunday's West Coast division accounting department in Los Angeles, having been associated with Sunray and merged companies since 1927.

Stine succeeds **Ben L. Young** who retired recently. **J. Floyd Ladd** was named assistant manager of the general office department and **John E. Scott,** chief accountant.

•

J. L. (Jim) Callahan has been promoted to utilities engineer for the Service Pipe Line Company and will have charge of all contract negotiations with utility companies serving the company, with headquarters in Tulsa. An electrical engineering graduate of Oklahoma University, Callahan worked for electrical supply houses in Tulsa and Muskogee, Okla., before joining Shell Oil Company in 1934.

He joined the engineering department of Service Pipe Line Company in 1946, and aided in planning and designing several of the company's pump stations. Callahan is a registred professional engineer in Oklahoma and a member of the local Tulsa chapters of AIEE and PIEA.

•

Wayne E. Glenn, Los Angeles, Calif., petroleum engineer for Continental Oil Company's Western region, has been promoted to petroleum engineer for the Southern region, with headquarters in Houston.

Glen joined Conoco in 1943 as a petroleum engineer in New Mexico. He was transferred to company offices in Ponca City, Okla., in 1944 and to Los Angeles three years later. He received his engineering degree from the University of Oklahoma, Norman, in 1940.

•

W. B. Berwald, assistant chief petroleum engineer at Findlay, Ohio, since 1946, has been named assistant division manager of the Shreveport, La., Production division by The Ohio Oil Company. Berwald was succeeded at Findlay by **W. H. Barlow,** petroleum engineer. At the company's Houston office, **J. D. Anderson,** manager of the Purchasing department, has been appointed assistant division manager of the Houston Production division. **E. W. Shoupe,** in addition to his present capacity as purchasing agent, has been appointed manager of the Purchasing department, succeeding Anderson. **M. E. Loose,** assistant to the manager of the Purchasing department, has been named to the newly established position of assistant manager of the Purchasing department.

•

R. R. McCarty, Humble Oil and Refining Company, has been named assistant division superintendent of the Louisiana division, relieving **J. G. Sloan,** who is absent because of illness . . . **William Eddis Diamond,** rotary driller, Humble Oil and Refining Company, was promoted to toolpusher at the Paradis district, Louisiana division . . . **R. L. Meadows,** relief toolpusher for Humble Oil and Refining Company, London district, transferred to the North Texas division as toolpusher . . . **L. B. Parker,** senior civil engineer, transferred from the Gas Construction division to the Clear Lake Construction district as district civil engineer.

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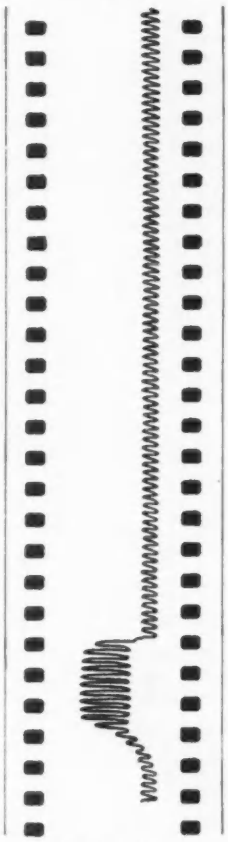

Specimen of tape indicating saturation

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KING OIL TOOLS

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Carl G. Herrington, manager of production, has been elected a director of The Carter Oil Company. A native of Tecumseh, Okla., Herrington received his civil engineering degree from Oklahoma A. & M. College, Stillwater, in 1934. He began 18 years of continuous Carter service that year as a roustabout in the production department at Crescent, Okla., and was made a petroleum engineer in 1937. Subsequently he was named chief production engineer, Eastern Division superintendent, assistant manager of production, Tulsa, and manager of production in 1948.

William K. Powell has joined the *Petroleum Training News Letter* staff as specialist in management and supervision. A graduate of Southern Methodist University, Powell has been in the oil business for more than 20 years and has engaged in scouting, leasing, contract drilling and production activities. A writer, he has contributed to oil trade journals and is the author of a two-volume work on accounting for contract drillers. During the current year he presented six institutes on management methods to 125 production and drilling company employes in Calgary and Edmonton, Canada.

Cecil L. Burrill has been elected a vice president and director of Creole Petroleum Corporation. Burrill has been directing Creole's New York office. A graduate and former member of the faculty of Harvard Business School, he joined Creole in 1949 and prior to that time was head of the Budget department and petroleum economist for Standard Oil Company (N. J.). He recently served as director of the program division of Petroleum Administration for Defense while on 18 month leave-of-absence from Creole.

•

F. L. Merry has been assigned the responsibility for the Red Wash-Uinta Basin activities in addition to his capacity as area superintendent at Rangely, Colo., for The California Company. In addition **R. L. Green** has been promoted to engineer in charge of the Red Wash-Uinta Basin activities, while **M. E. Kinnebrew** succeeds Merry as area superintendent at Brookhaven. **R. E. France** has been named division operating superintendent in the North Louisiana-Mississippi Division of The California Company.

•

C. R. Canfield has been named division geologist for the Central division of Stanolind Oil and Gas Company. Canfield succeeds E. W. Price.

Canfield was formerly division geologist in Stanolind's Texas-Louisiana Gulf Coast division at Houston. He was transferred to the Central division office as division consulting geologist at Oklahoma City in 1949. He has been with Stanolind since 1941, having formerly been associated with oil companies both in the U. S. and South America.

Canfield was graduated in 1929 from U.C.L.A. with an A.B. degree in geology, and in 1933 received his M.A. from Columbia University.

•

R. C. Schmidt, formerly with Loffland Brothers Drilling Company in West Texas, has joined Carl B. King Drilling Company of Midland, Texas, as contract representative.

•

C. W. Payne has resigned as division geophysicist for The Pure Oil Company in Fort Worth and has opened a geophysical consulting office at 1223 Fair Building, Fort Worth.

•

Frank L. Thompson, associated with Thompson-Carr, Inc., drilling contractors, since 1946, has been elected vice president and director of the company. A Texas A. & M. College student, he served as an Infantry officer from 1940 to 1946, at which time he became associated with Thompson-Carr. Thompson's home is in Midland, Texas.

•

C. C. (Sonny) Bankhead has joined the staff of Avila Oil Company. Bankhead was with the Shell Oil Company from 1933 to 1946 as exploitation engineer and subsurface geologist; and from 1946 until the time of joining Avila, was a consulting geological engineer with offices in Abilene, Texas. Avila, with offices in Continental Life Building, Fort Worth, was organized in May, with **Chester M. Crebbs**, president. Crebbs retired as president of Mene Grande Oil Company, Caracas, Venezuela in 1949.

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October 16-19, Odessa, Texas

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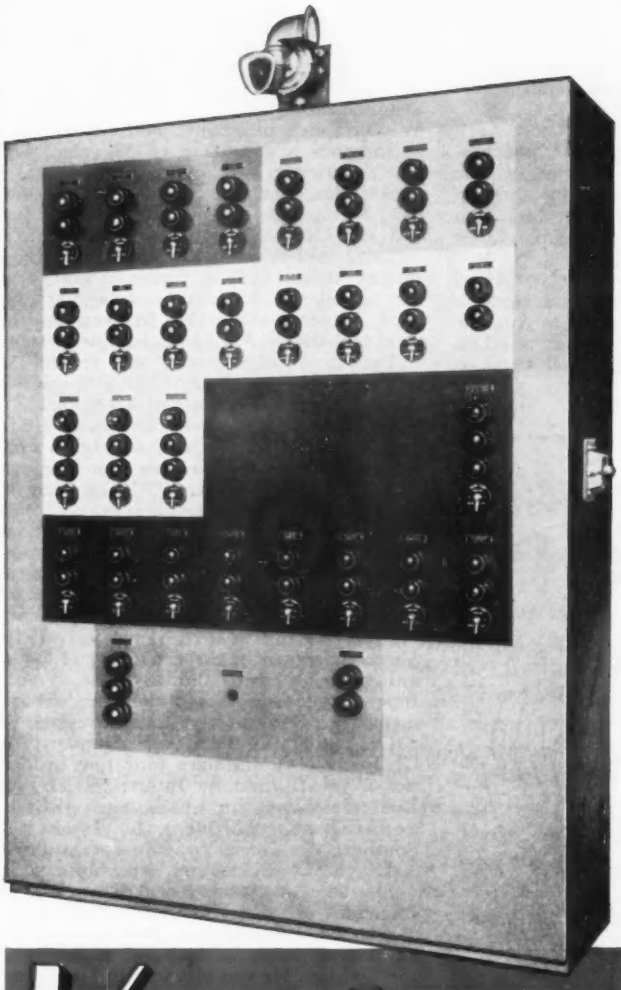

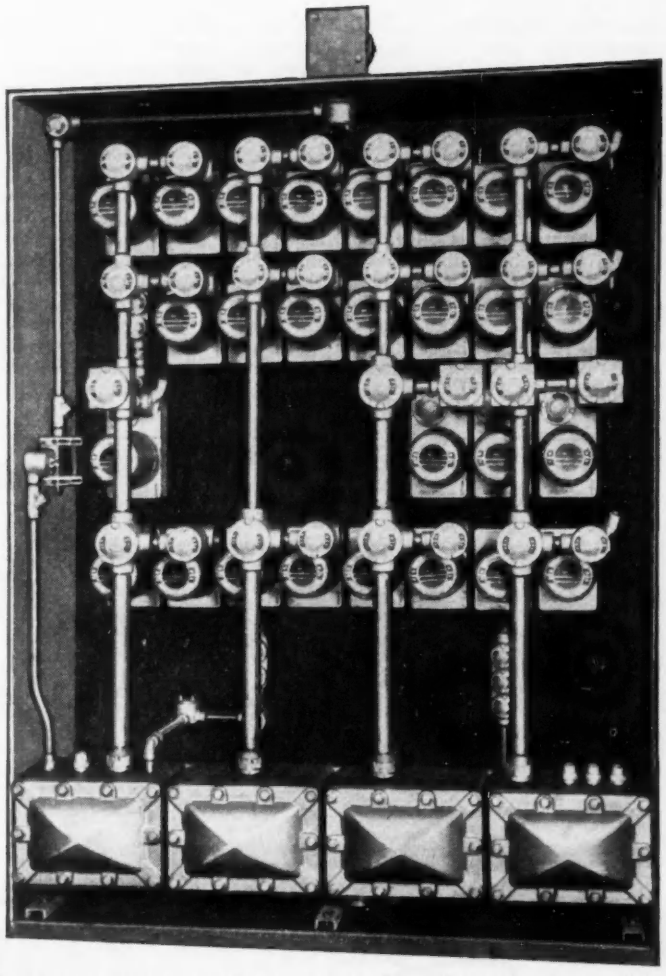

Front and rear views of alarm panel containing 27 Type EKP explosion-proof Visularms built for a chemical plant.

Visularm CONDULETS®

safeguard continuous production by instant warning of abnormal conditions

1. **Pilot lights** give visual indications of normal and abnormal temperature, pressure liquid level, speed, load or other conditions.
2. **Bell or howler** can be used to give an audible signal. A single bell or howler can serve any number of *Visularms.*
3. **Flashing light** instantly directs attention to the proper control station.
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5. **Compact and easy to install.** Occupies little space on the control panel. Only requires round drilled holes.
6. **Accessible** . . . . all actuating devices are on a factory-wired, jack-mounted plate which can be quickly removed for servicing and a spare can be inserted to maintain operation.
7. **Two-light and three-light** *Visularms* are available; any number can be mounted in either vertical or horizontal rows on a control panel. Type EKP *Visularm* is explosion-proof and Type KP *Visularm* is dust-tight and weather-resistant.

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Harry A. Trueblood, Jr., formerly associated with The California Company's barge and inland drilling operations in Mississippi and Louisiana, and with McDermott and Barnhart in Colorado and West Texas, has opened a consulting office in Sterling, Colo.

•

Dr. R. L. Lupher, a member of the faculty of Washington State College at Pullman for 14 years, has been appointed to Shell Oil Company's Pacific Coast area exploration staff. An associate professor of geology at Washington State, Dr. Lupher was awarded his Ph.D. degree in geology and paleontology by the California Institute of Technology in 1930.

Cyril J. Perusek, geologist for Residue Research Laboratory, Midland, Texas, for the past four years, has resigned to serve as geologist at Phillips Petroleum Company's Midland plant.

•

E. C. Borg has been appointed purchasing agent for the Central division of The Texas Company with headquarters in Chicago; **Philip Hauck** will replace him as purchasing agent for the Pacific Coast division in Los Angeles.

Borg, a native of Los Angeles, joined The Texas Company in 1929 as clerk in the Purchasing department at Los Angeles, becoming buyer in 1939, assistant purchasing agent in 1949, and divisional purchasing agent in 1950.

S. R. Simmons, manager of the southern division of Interstate Oil Pipe Line Company, Shreveport, has been elected a member of the board of directors. Simmons assumes the board position vacated by S. W. Day, vice president, who retired.

Simmons is a veteran of 39 years pipe line experience, having been first employed as a station oiler at Oxford Station, Louisiana, by the pipe line department of Standard Oil Company of Louisiana in 1913.

Until called to active military service during World War I, Simmons served as station oiler and station engineer at Oxford, Moore and Bunkie Stations on the Arkansas-Baton Rouge main line system.

During World War I he served 18 months as commanding officer of the 154th Aero Pursuit Squadron, with one year of this period being spent overseas. Upon termination of his military service in February, 1919, he resumed his pipe line employment with Standard Oil Company of Louisiana, serving temporarily as chief engineer at Moore and Oxford Stations before moving to Bunkie Station for almost 17 years. At Bunkie, Simmons served as station chief engineer, general foreman and later district foreman.

From April, 1937, to January 1, 1945, Simmons served in the capacities of assistant superintendent and assistant general superintendent of the Pipe Line department with headquarters in Shreveport.

On January 1, 1945, when Standard Oil Company of Louisiana's pipe line properties were acquired by Interstate Oil Pipe Line Company, he was named assistant general superintendent of Interstate's Southern division embracing operations in Arkansas, Louisiana and Mississippi.

Simmons was promoted to general superintendent of the Southern division on January 1, 1946, and in 1949 was assigned additional duties as assistant manager of the division. He was elevated to his present position as division manager on September 1, 1951.

•

Roland E. Koepp, former district superintendent for the Texas-New Mexico Pipe Line Company of Eunice, New Mexico, has opened an engineering and surveying service at 984 West San Antonio Street, New Braunfels, Texas, specializing in oil field pipe line work.

•

W. C. (Bill) Slocum Jr., district manager for Rinehart Oil News Company, Dallas, has resigned from the firm, effective September 15, to become a partner in the A-B Letter Shop, Dallas.

•

William K. Brewster, formerly land man for Magnolia Petroleum Company at Dallas, has been transferred to Socony-Vacuum Oil Company, Inc., for duty in that company's general offices in New York.

•

Charles R. Bell, director of the tax division of Continental Oil Company's legal department, has moved his headquarters from Ponca City, Okla., to Houston, with **V. D. Arntzen**, assistant director of the tax division, appointed to direct the Ponca City office.

Bell joined the company in 1949 as assistant chief of the tax division and was promoted to director in 1951. He formerly was associated with Kerr-McGee Oil Industries, Inc., and Arthur Andersen & Company, Houston accountants.

REMOVES SAND AND SHALE BY NEW FLOTATION PROCESS

"Rumba" Shale Shakers excel in performance and low cost maintenance. They come to you completely unitized on 10 ft. skids . . . no rigging up costs in the field. The underslung screen cloth, with no obstructions on the bottom removes sand by a new method of flotation which reduces wear on pumps. This design contributes to the longer screen cloth life . . . one of the features that is causing the worldwide demand for "Rumba" Shakers.

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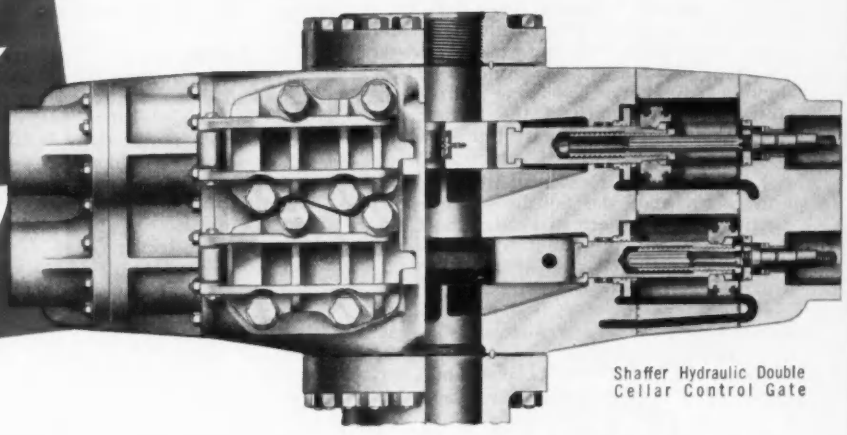


Shaffer Hydraulic Double Cellar Control Gate

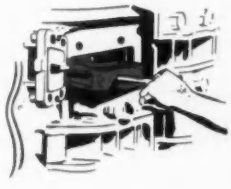
...and see why so many operators prefer Shaffer Control Gates!

When you buy Cellar Control Gates don't stop at safety alone. Safety, of course, is the most important single advantage to be gained in a Cellar Control Gate installation—and in Shaffer Hydraulic Cellar Control Gates you get field-proven protection backed by the organization that pioneered cellar control gates well over a quarter-century ago. But be sure to check the additional vital advantages provided by Shaffer Hydraulic Cellar Control Gates—check them point-by-point against *any other* cellar control gate in the industry . . .

✓CHECK: COMPACTNESS!

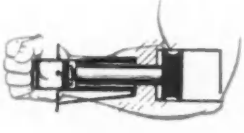
Compact control gate equipment cuts costs in many ways—shallower cellar requirements, simplified hook-ups, easier storage and shipping. Even in sizes as large as 13⅜" (12" Series 900), Shaffer Hydraulic **Double** Cellar Control Gates (**two** ram compartments unitized in **one** body) require only 30" total height. Shaffer Hydraulic **Single** Cellar Control Gates require only 18½" in the same size—smaller sizes, even less. Check these compact dimensions against those of **any other** gate of comparable size and rating!

✓CHECK: EASY RAM CHANGES



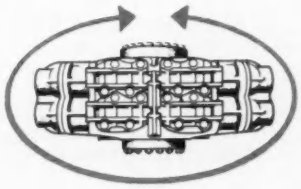
As wells are drilled, rams must be changed frequently to meet requirements of varying pipe sizes. In Shaffer Hydraulic Gates ram changes are unusually easy—simply open two doors in the side of the body, slide out the ram assembly, change rams, slide the assembly back in place and bolt the doors. **Moreover, complete ram changes can be made with equal ease whether the pipe is in or out of the hole!**

✓CHECK: POSITIVE DIRECT DRIVE!



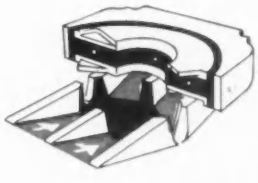
Shaffer Hydraulic Gates have no complicated hook-ups or secondary connections between rams and operating cylinders. Operating pistons are **directly behind** the rams for positive fool-proof drive, fewer parts, simple maintenance!

✓CHECK: FULLY-ENCLOSED DESIGN!



Note how Shaffer Hydraulic Cellar Control Gates have no exposed moving parts. All operating members are enclosed **within** the gate body—protected from corrosive muds, from abrasive grit and sand, from jamming by loose timbers or other objects dropped into the cellar. Even the locking shaft is non-rising—fully protected!

✓CHECK: MUD-FREE DRAINAGE!



In Shaffer Gates the rams move on high narrow guide ribs above the steeply-sloped ram compartment bottoms. Mud and sand quickly drain back into the well—no detrimental accumulations to interfere with free opening and closing of the rams!

Individually, every one of these features represents a vital operating advantage. Yet you find all these points of superiority in Shaffer Hydraulic Cellar Control Gates.

No wonder performance-minded operators have made Shaffer Gates their leading choice the world over. Your nearest Shaffer representative will gladly supply complete details on Shaffer Equipment. Or write direct!

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See the Shaffer section of your Composite Catalog for data on the complete line of Shaffer field-proven tools and equipment!

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R. M. Wemple, former district production foreman of the Valley district, has been promoted to district superintendent and given supervision over the new Southwest Louisiana district of Pan American Production Company. The new district includes the area south of the Intracoastal canal and west of the east line of Cameron parish, Louisiana.

J. V. LeBlanc, former district production foreman of the Southeast Louisiana district of Pan American Production Company, has been promoted to district superintendent of that district. Headquarters are in Valentine field near Lockport, La.

Replacing Wemple as district production foreman in the Valley district is **R. M. Decker**, former production foreman in the Southeast Texas district. **C. W. Daniel**, formerly head roustabout at Olive field, has been promoted to production foreman, replacing Decker in the Southeast Texas district.

J. H. Todd, formerly chief operator of the Willamar pressure maintenance plant in the Valley district, has been promoted to pressure maintenance plant foreman. Todd has been replaced by **William Steward**, former auto mechanic, as chief operator of the maintenance plant.

Changes in the exploration department of Pan American Production Company have resulted in formation of a geophysical section supervised by **O. T. Lawhorn**, section head, and a drafting section supervised by **W. O. Shands**, section head.

Lawhorn was formerly chief geophysicist of the exploration department. Shands was formerly chief draftsman of the geological drafting section of the civil engineering department, which has been transferred to the exploration department under **Ben H. Martin**, department superintendent.

•

Dr. John R. Bates has been named technical adviser to the executive committee, a newly created position, by Sun Oil Company, and will conduct investigations of processes as they are developed, keeping informed of markets and market trends for petrochemicals and petroleum products. Assocated with Sun Oil Company since 1942, Dr. Bates has headed research and development activities for the past five years.

Dr. J. Bennett Hill director of the Chemical Research and Development department, will take over Dr. Bates' responsibilities in that department.

•

Clifton S. Corbett, manager of Socony-Vacuum Exploration Company, Calgary, Alberta, will be transferred to the New York office as advisor to the coordinator of domestic production. **Hiram R. Moorman**, chief geophysicist of Socony-Vacuum, will succeed Corbett at Calgary. With the recent retirement of **Dr. Arthur E. Fath**, **Edward C. Cram** will follow Canadian operations along with other duties as assistant to the coordinator of domestic production. All reassignments are effective October 1.

•

Gordon H. Gray, recently returned from one year's duty with the U. S. Marine Corps, has been promoted to superintendent of Drilling and Production by Condor Petroleum Company, Abilene, Texas. Gray formerly was petroleum engineer and production superintendent for the Abilene district for Condor.

•

Raymond A. Williams, Jr., Dallas, has been appointed land manager of oil and real estate holdings of **M. B. Rudman**, Texas independent oil operator with extensive holdings in the Williston Basin. Williams will headquarter in Dallas and in Denver where Rudman has purchased the historic Navarre Building. Formerly a partner with the Dallas law firm of Alexander, George, Russell and Passman, Williams is a law graduate of Southern Methodist University.

•

A. E. Woerheide, Jr., of Wichita, Kansas, has been appointed petroleum engineer for Byrd Oil Corporation, Dallas, which has interests throughout Texas, and also Okla., N. M., Colo., Mont., N. D., and Utah. Woerheide's experience includes service with Shell Oil Company, which he joined in 1936, and four years service with the U. S. Army Corps of Engineers during the war. For the past three years he had been in charge of all Shell exploitation engineering activities in Kansas. He received his engineering degree from Missouri School of Mines.

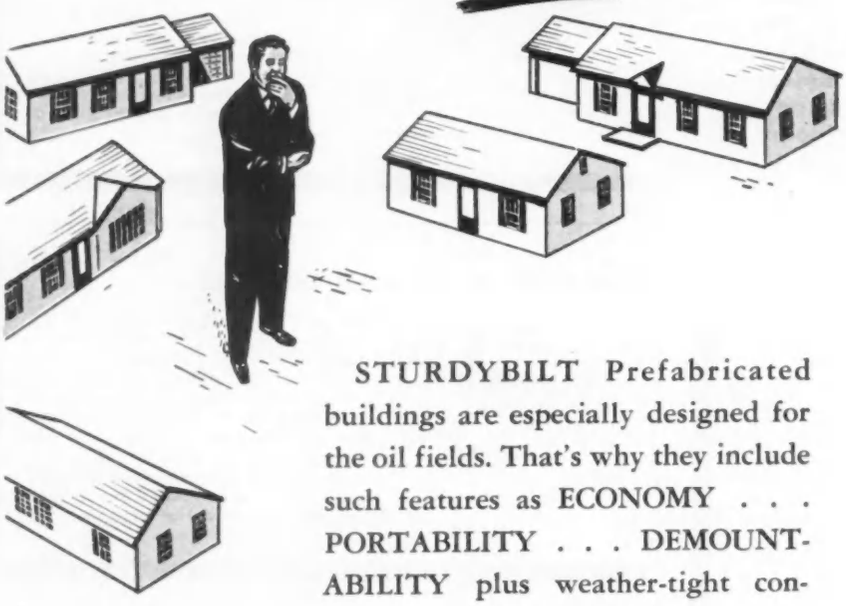
•

J. L. Tatum, independent geologist, has moved his residence and office from Albuquerque, N. M., to Durango, Colo.

•

R. N. Freehling, The Texas Company, Producing department, has been advanced to district petroleum engineer at Casper, Wyo., replacing John B. Flugstad, resigned. Freehling graduated from the University of Pittsburgh, has since served The Texas Company in Montana and Colorado.

CHOOSE THE FIELD HOUSING DESIGNED FOR *YOU*...



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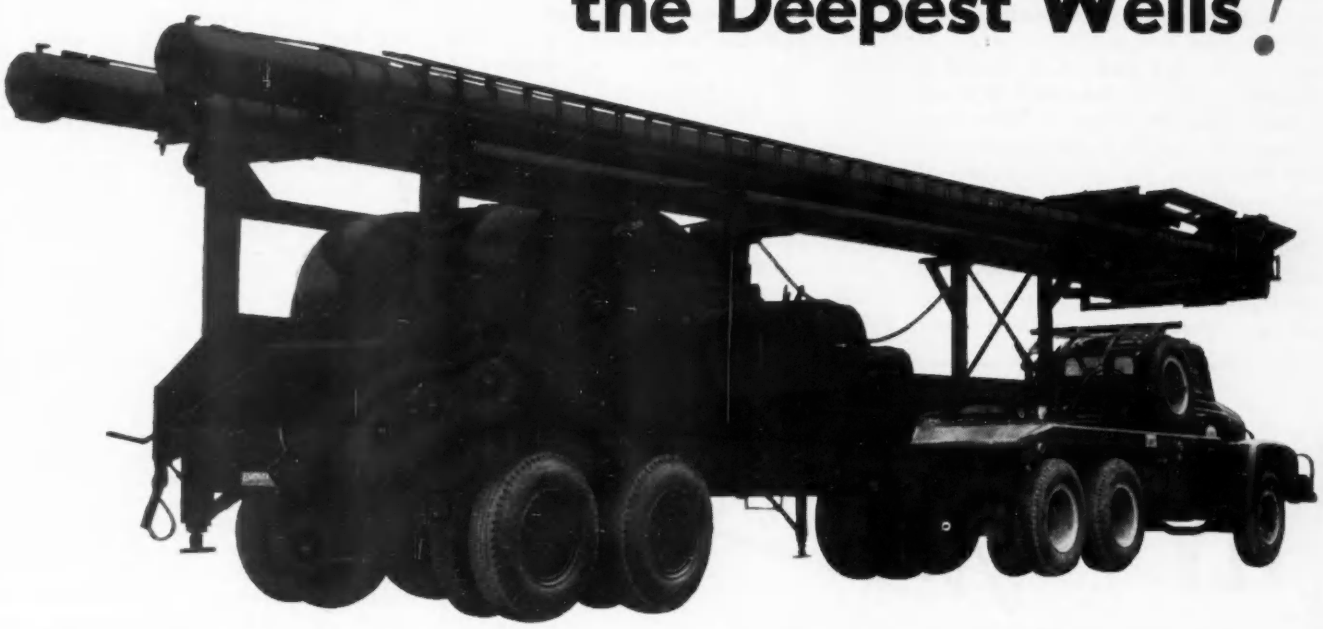
The Latest for Servicing the Deepest Wells!



COOPER D 50 TRAILER RIG

For Work-Over and Servicing the Deepest Wells and Rotary Drilling at 5,000 ft. Equipped with 91-ft. extra heavy duty 2-pole telescoping mast with tubing board and rod hanger.

Every modern feature of design is incorporated in these new units: TORQUE CONVERTER, 3-speed and reverse transmission; OIL BATH DRIVES; HYDRAULIC RAMS for raising mast; Rod Hangers and Tubing Board; EXTRA CAPACITY 52″ dia. x 10″ face brakes to handle the heaviest loads without use of auxiliary braking equipment; POWER by GM Model 8107 Twin Four Diesel Engines; and numerous other outstanding features.

BUILT IN THREE SIZES AS SKID UNITS OR TRAILER RIGS

Regardless of the depth of wells, there is a Cooper—Allis-Chalmers Winch of the right capacity to do the job economically.

A Cooper Sales Engineer will be glad to furnish more detailed information on this outstanding rig

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Houston, Odessa, Los Angeles

H. F. Crandall, division land manager for Shell Oil Company at Bakersfield, moved to the Los Angeles office as area land agent and will act for the land manager in his absence. **C. T. Crewell,** formerly division land manager at Ventura, and presently in Los Angeles on special assignment, will go to Bakersfield to succeed Crandall. **R. W. Wingo** is being transferred from Canada to Los Angeles as an area land agent to augment the company's land organization.

•

Charles J. Deegan, associate of Cummins & Brinkerhoff, consulting engineers of Fort Worth, has resigned and plans to establish his own consulting and advisory service.

A. L. (Jack) Barnett, Jr., Dallas, independent oil operator and partner in the firm of Clardy and Barnett, has been elected a director of Texas Empire Life Insurance Company, newest life insurance firm in Dallas and fiftieth legal reserve life insurance company to establish its home office in Dallas.

•

William N. Sorensen has been promoted to senior engineer by Sohio Pipe Line Company, St. Louis. Sorensen, a 1949 graduate of the University of Nebraska in Electrical Engineering, joined Sohio as a junior engineer upon graduation. His headquarters will continue to be St. Louis.

FLY *Westwind* SERVICE

TRANS-TEXAS NEW WEST TEXAS COMMUTER FLIGHTS

3 Trips Daily Each Way

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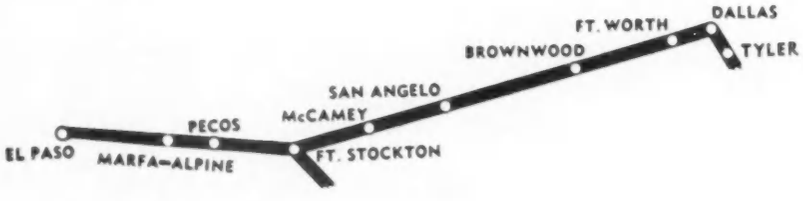

Trans-Texas Airways' "Westwind" Service—morning, noon or night—provides excellent service for businessmen between Dallas-Ft. Worth and San Angelo. You're there and back the same day with plenty of time to spare when you fly fast "Westwind" commuter service!

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SOUTH OF THE STARLINERS

GENERAL OFFICES — HOUSTON, TEXAS

Transfers and Promotions:

Sinclair Oil & Gas Company announced that **W. T. Crandall,** division superintendent at Midland, Texas, has been transferred to Fort Worth, and will supervise the Northeast Texas division which includes the North Texas, East Texas, Louisiana North and South, and Mississippi districts. **J. T. Reeves,** division superintendent at Independence, Kansas, transferred to Midland, and will supervise the West Texas-New Mexico division, consisting of the Big Spring, Crane, New Mexico, Odessa, Panhandle and Wink districts. Following are other Sinclair Production department reassignments:

Oran W. Mitchell, intermediate petroleum engineer at Midland, is transferred to Big Spring, Texas. **Theodore F. Hoss,** district foreman at Wink, Texas, is transferred to Seminole, Okla. **Lindal Buchanan,** intermediate petroleum engineer, Ardmore, Okla., transferred to Oklahoma City. **Cameron L. Cox,** intermediate petroleum engineer, Columbus, Texas, promoted to assistant foreman. **Bobbie L. Howell,** junior petroleum engineer, Tulsa, is promoted to intermediate petroleum engineer and transferred to Ardmore. **Charles L. Simons,** intermediate petroleum engineer at Thrall, Kansas, promoted to senior petroleum engineer and transferred to Delaware, Okla. **Dennis L. Krehbiel,** junior petroleum engineer, Thrall, is promoted to intermediate petroleum engineer. **Vernon L. Hughes,** junior petroleum engineer, Lindsay, Okla., transferred to Tulsa. **Chester R. Smith,** junior petroleum engineer, Odessa, Texas, transferred to Big Spring, Texas. **Joseph P. Collins,** junior petroleum engineer, Delaware, transferred to Thrall. **Claude D. Gaines,** division engineer at Tulsa, transferred to Fort Worth. **Byron L. Plumley,** intermediate petroleum engineer at Delaware, promoted to senior petroleum engineer and transferred to Ardmore. **Gilbert L. Price,** junior petroleum engineer at Oklahoma City, transferred to Lindsay, Okla. **James A. Shelton,** junior petroleum engineer at Gainesville, Texas, transferred to Midland and promoted to intermediate engineer. **Robert A. Bonnell, Jr.,** senior petroleum engineer at Odessa, promoted to district foreman and transferred to Crane.

In The Texas Company's Producing department, **E. E. Beeman,** district geologist for Wyoming, has been transferred to Lewistown, Mont., replacing **K. R. Parsons,** resigned, as district geologist. **O. A. Saterdal,** district geologist for western Colorado and Utah, transferred from Salt Lake City to Casper, Wyo., replacing Beeman. **R. E. Hunt** has been promoted from geologist at the Rocky Mountain division office at Denver to district geologist at Salt Lake City.

Kenneth R. Joynt has been promoted from assistant district superintendent of Magnolia Petroleum Company's Vanderbilt Producing district to district superintendent. In that position he succeeds the late **C. G. Worthy. Louis M. Ayers** has been promoted from production foreman in the company's La-Gulf district to district superintendent of that district with headquarters at Morgan City, La. **A. H. Massad,** formerly district petroleum engineer of Magnolia Petroleum Company's Wewoka district, has been transferred to the Cushing Producing district with head-

quarters at Drumright, Okla. **A. J. Monzingo,** who has been a petroleum engineer in the West Texas division offices at Midland, has been moved to the Wewoka Producing district and promoted to district petroleum engineer. **John L. Moye,** petroleum engineer in the Rodessa Producing district, has been transferred to the Shreveport division offices. **L. N. Halstead,** petroleum engineer in the Duncan, Okla., Producing district, has been transferred to Magnolia's Electra district. **Glen W. Barb,** formerly pertoleum engineer at Vanderbilt, has been moved to the Duncan Producing district. **Cecil M. Rhodes** has been promoted from marine foreman to production foreman in Magnolia Petroleum Company's Louisiana-Gulf division. This division has charge of Magnolia's offshore drilling operations. **Travis H. Bryant** has been promoted from driller to drilling tools foreman in the Gulf Coast Drilling division. In the Exploration division, **Basil Moss** has been transferred from Mt. Vernon, Ill., to New Orleans, as a landman. There he will be in charge of the New Orleans district which has been newly created and which comprises 22 counties in southern Louisiana.

Honolulu Oil Corporation announces the following promotions in the Mid-Continent division, Midland, Texas: **Clifton Wilderspin,** from scout to assistant landman; **W. A. Thompson,** assigned to Wilderspin's duties working with the geological department; **Jack Prothro,** transferred to Billings, Mont., to look after the company's interests in the Williston Basin.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF WORLD OIL, published monthly at Houston, Texas, for October, 1952.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ray L. Dudley, 3371 Chevy Chase, Houston, Texas; Editor, Warren L. Baker, 5324 Cherokee, Houston, Texas; Managing Editor, Al Reese, 9112 Westview, Houston, Texas; Business Manager, A. L. Burns, No. 7 Chelsea Place, Houston, Texas.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

The Gulf Publishing Company, Houston, Texas; James Anderson, Houston, Texas; June Wooden Bliss, Houston, Texas; June Wooden Dudley Bliss—Trustee, Houston, Texas; A. L. Burns, Houston, Texas; Mrs. Grace C. Carter, Tulsa, Oklahoma; Mrs. Margaret D. Cashman, Houston, Texas; P. Stinson Dudley, Gainesville, Texas; Ray L. Dudley, Houston, Texas; Wm. G. Dudley, Lake Jackson, Texas; Wm. V. Gross, Utopia, Texas; Carolyn Dodson Keeble, Ennis, Texas; Mrs. Anita S. Lane, Houston, Texas; Charles H. Lane, Houston, Texas; James William Nelson, Baytown, Texas; Tom W. Nelson, Houston, Texas; J. Kent Ridley (Deceased), Houston, Texas; Walter Gage Sterling, Trustee, Houston, Texas; O. R. Waller, Chicago, Illinois; Mrs. Patricia McFarland Windham, Austin, Texas.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) M. D. Anderson Foundation, Houston, Texas.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

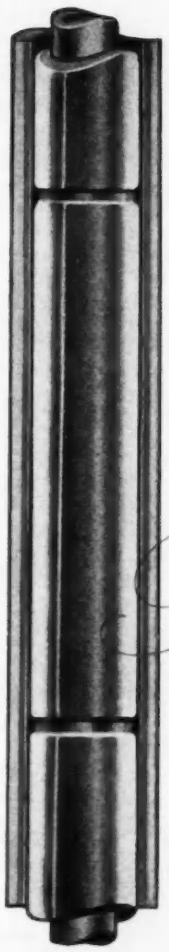
A. L. BURNS, Business Manager.

Sworn to and subscribed before me this 8th day of September, 1952

P. J. AUCOIN,

(Seal) Notary Public in and for Harris County, Texas.

(My commission expires June 1, 1953.)



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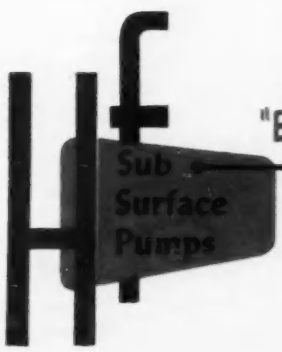
ROD PUMPS

run longer in tough wells

. . . because particular attention is given to the working fit of each assembly so that the close-fitting plunger and barrel tube will give long, efficient service. The barrel tubes are tough, non-gaulding seamless steel, machine-straightened, and finished to a perfect inside working surface. The plunger is a composite type, consisting of several 12" sections perfectly aligned on a seamless steel mandrel tube. Three combinations are available: *Standard Precision,* with plain steel barrel tube and alloyed cast iron plunger for moderate wear under average pumping conditions; *Precision-H,* with a hard, chrome-plated barrel tube and hardened plunger (of Ni-hard, a corrosion-resistant, nickel alloyed casting of inherently hard material) for abrasive and/or corrosive fluids, and *Precision-P,* with plain steel barrel tube and one-piece, chrome-plated plunger for hard-pumping wells.

If pulling jobs are costing you the price of a Precision Pump, why not run one to begin with? Ask your supply store — they'll tell you it's the best pump in the oil patch. Set one in your next well and see for yourself. H-F Precision Pumps, pump parts and accessories, and other production equipment are sold from stock by leading stores throughout the oil country. Factory representatives in all major producing areas. Harbison-Fischer Mfg. Co., P.O. Box 64, Ft. Worth, Texas.



"Best Pumps In the Oil Patch"

HARBISON
· FISCHER

DEATHS

Harry F. Mitchell, 67, treasurer of the Union Gas System, Inc., and a civic leader of Independence, Kansas, died September 1. Mitchell had been with Union Gas for more than 30 years, and was also an officer of Midland Industries, Inc., and Gibraltar Finance Corporation.

•

Houston Crump, 48, manager of the Odessa Chamber of Commerce and more recently assistant to the president of First State Bank, Odessa, Texas, died September 2 in Odessa. Crump had been active in welfare and community projects, and had served as director of the Veterans Service Center at Odessa for a number of years. In addition he had been manager of the Permian Basin Oil Show since its inception.

Herbert F. Miller, 66, retired vice president and director of The Carter Oil Company, died August 4 in Tulsa. He entered the industry in 1902 as an office boy for the Standard Oil Company of New York and subsequently served with Standard companies for more than 48 years. In 1921 he was assigned to Tulsa as head of Carter's crude oil department, becoming a director in 1937 and vice president in 1947. Since his retirement from Carter in 1951 he had served as district manager of the crude oil department of the Rock Island Refining Company of Indianapolis, Ind., from headquarters in Tulsa.

•

Thomas J. Green, 77, pioneer Oklahoma independent oil operator, died August 11, in Tulsa. He was active in developing production in various Oklahoma areas.

•

Perry E. Thompson, 65, superintendent of the Lima division, Pipe Line department, The Ohio Oil Company, died July 17 in Lima, Ohio. Thompson began his pipe line career in 1906 with the Prairie Oil and Gas Company and joined The Ohio Oil Company in 1912 as assistant fireman at Bluffton, Ind. He had been retired July 1, after 40 years of service.

•

John C. Lindsay, 68, retired civil engineer for Western Gulf Oil Company, died September 3 in Beverly Hills, Calif. Lindsay, a resident of Southern California for 65 years, retired from active service in 1950.

•

L. E. Sloan, 63, district production superintendent for Stanolind Oil and Gas Company and a company veteran of 21 years, died August 19 at Abilene, Texas.

•

Ralph C. Fleming, 52, former Tulsa drilling contractor and one-time employe for the old Marland Oil Company at Ponca City, Okla., died August 14 at Wichita, Kansas.

•

Elmer E. Adams, retired independent oil operator, died August 15 in Tulsa. He helped develop a number of oil fields in Oklahoma and Kansas.

•

Henry L. Hummel, 57, independent geologist, died August 22 in Houston. A member of the American Association of Petroleum Geologists, Hummel had operated from headquarters in Houston for the past 17 years.

•

F. A. Simmons, 64, Houston oilman, who had established residence at Pacific Palisades in late years, died July 30 in Beverly Hills, Calif.

•

Fred H. Matthews, 57, manager of Crude and Products department, and a member of the Western Division Operating Committee of Tide Water Associated Oil Company, died in August at Oakland, Calif. Matthews joined Tide Water Associated more than 39 years ago as an office boy in the San Francisco general office.

•

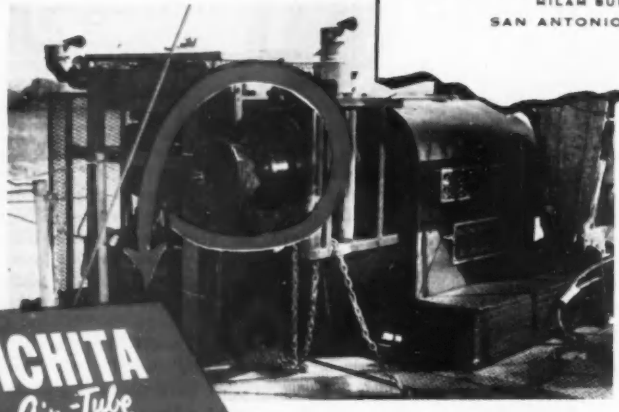
Harry Maxwell, 60, former manager of Industrial Relations for Sun Oil Company and a Sun employe for more than 32 years, died August 9 in Fort Lauderdale, Fla. Maxwell served Sun at Bakersfield, Calif., and in Venezuela, but is best remembered for his work in industrial relations where he exhibited an unusual capacity for understanding human behavior. It was Maxwell who in 1930 secured the rights-of-way for the Susquehanna pipeline which carries Sun products from Marcus Hook to Cleveland.

•

Sheldon Clark, 75, Sinclair Oil Corporation, died August 15, in Chicago. Clark joined the Sinclair company in 1916, the year it was organized, and had served as director since that time.

Superior — says ARTHUR P. BUZZINI

BUZZINI DRILLING COMP
MILAM BUILDING
SAN ANTONIO 5, TEXAS



WICHITA Air-Tube CATHEAD

"We have found Wichita Catheads superior to other catheads by the following features:

(1) *Complete air operation* instead of air engagement and mechanical disengagement; (2) *Well balanced* with *sufficient power* to spin-up joints, tong them tight, break out tough ones and still not snap lines or bend joints; (3) *Completely reliable*, makes up all joints exactly alike, needs no adjusting; (4) No injuries since installation; (5) So trouble-free, we have never needed repairs. We are completely SATISFIED WITH WICHITA CATHEADS! They will be installed on all our future rigs!"

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WICHITA FALLS FOUNDRY & MACHINE CO., INC.
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ANOTHER OUTSTANDING WICHITA PRODUCT

COMPANIES IN THE NEWS

MAGNOLIA PIPE LINE COMPANY has announced multiple changes on its staff. **B. B. Balke**, who has been chief gauger of Magnolia Pipe Line Company's Northern division, has been promoted to assistant district superintendent of the Healdton district. **Elmer E. Adams**, formerly gauger foreman at Maud, Okla., has been promoted to chief gauger of the Northern division with headquarters at Healdton, Okla.

A. T. Pasche, assistant mechanical engineer in Magnolia Pipe Line Company's general offices in Dallas, has been transferred to the Western division as assistant mechanical engineer with headquarters at Midland, Texas. **B. G. Christopher**, formerly junior mechanical engineer, has been promoted to assistant mechanical engineer and moved from the Telephone and Telegraph department to the Mechanical Engineering department, Dallas general offices.

D. H. Handley, who has been junior mechanical engineer, has been promoted to assistant mechanical engineer and transferred from the Telephone and Telegraph department to the Healdton Pipe Line district. **R. C. Davidson**, formerly assistant construction foreman in East Texas, has been promoted to construction foreman with headquarters at Corsicana, Texas. **P. C. Culpepper**, truck driver in Magnolia Pipe Line Company's East Texas district, has been promoted to assistant construction foreman in the Company's East Texas district with headquarters at Greggton, Texas.

•

THOMAS P. PIKE DRILLING COMPANY, Los Angeles, has extended its contract drilling service to the Rocky Mountain area oilfields through a newly formed subsidiary, DYE-PIKE DRILLING COMPANY. Dye-Pike has opened offices in Casper, Wyo. The California company is moving a number of its drilling rigs to the new area for use as drill farmouts for other oil companies as well as for straight contracts.

•

AJAX PETROLEUMS LIMITED has expanded its interests to include participation with ALBERMONT, TRANSERA and ERAMONT PETROLEUMS in the Montana portion of the Williston Basin. Ajax is active in the White Bear Indian Reserve in the Saskatchewan, Canada, section of the Williston Basin.

•

COASTAL PETROLEUM COMPANY has reopened its Florida office in the Petroleum Building, Tallahassee.

•

THE CARTER OIL COMPANY has organized a department to deal principally with development of new methods to improve oil recovery. The new recovery methods section is headed by **Dr. Charles D. Russell.** Dr. Russell is a Ph.D. in Chemistry from Duke University and joined Carter in 1946.

•

WESCOL OIL AND GAS COMPANY offices in the City National Bank Building, Houston, were moved to Suite 1404 recently. Also involved in the move were the headquarters of **HOWARD S. COLE, JR.**, and **COLE DRILLING COMPANY OF VENEZUELA, C. A.**

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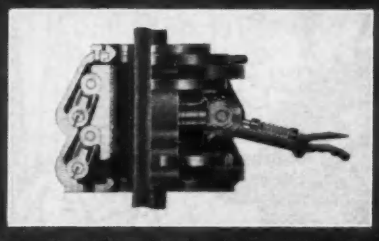
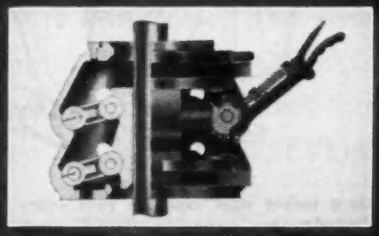
with the
KINZBACH
automatic tubing spider

ONE-MAN OPERATION
FAST, SAFE, POSITIVE GRIP
FULL RANGE
AUTOMATIC ALIGNMENT.



Running in. Slip segments are fully retracted



Slip Set. Note that slip segments are still parallel with the centerline of the pipe. Handle is locked in "closed" position.

This revolutionary development in Tubing Spiders, utilizes parallel-linkages to control the slip segments—a design which makes pipe handling faster and safer than ever before. The segments move at all times perfectly parallel with the tubing. The parallel slips provide a stronger grip than the conventional wedge design and will not gouge or score the tubing.

A single lever actuates the slips and they may be locked in either "open" or "closed" position. All segments are held in alignment with the tubing at all times and true radial closure is obtained.

The assembly is hinged and may be placed around the tubing without breaking a joint and may be used on wellhead fittings or set in the rotary bushing.

For complete information write for Bulletin 23151.

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SUN OIL COMPANY has opened new quarters in Beaumont, Texas, to house its production laboratory, which will be both a service lab and research center. The laboratory will assist in problems arising in drilling and production operations, evaluating results obtained and recommending changes in operations. It will also be the site of development of new products, instruments and methods for improving drilling and production operations.

Preston E. Chaney is the director of the laboratory which is located at 1096 Calder, eight blocks from the headquarters of the Gulf Coast division in the San Jacinto Building.

While located in the Gulf Coast division, the lab also serves other divisions of the company's Production department.

Sections included, and their supervisors, are:

Electric Logging and Core Analysis, **F. W. Brupbacher;** Drilling Fluids and Cement Research, **H. W. Perkins;** Corrosion and Analytical, **W. F. Oxford, Jr.;** Machine Shop, **W. E. Barnes;** Gas Lab, **E. C. Ward;** and Bottom-Hole Pressure and Caliper Survey, and the Reservoir Study Section.

•

DRILLING AND EXPLORATION COMPANY, INC., is moving its general office from Abilene, Texas, to Houston. Temporary executive, land and geological offices have been set up in Houston at Room 901, Lamar Hotel, to serve as the base of operations until the company's new offices at 800 San Jacinto Building are ready for occupancy.

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COMPANY_____

TITLE_____

ADDRESS_____

CITY_____ STATE_____

Robert L. Rose, formerly head of the company's California drilling operations, has been elected vice-president in charge of the Contract Drilling division with headquarters in Los Angeles. **Dr. David M. Grubbs,** who has served with the company for the past five years as chief geologist, has been elected vice-president in charge of the Land and Exploration division.

George I. McFerron, formerly division geologist for Sohio Petroleum Company in Houston, has joined the company as chief geologist. **Raymond E. Wiggins,** formerly associated with Amerada Petroleum Corporation and more recently an independent oil broker, has joined the firm as landman. **J. H. Lewis,** vice-president, who has been in the foreign service of the company for the past 12 years, has been appointed head of the company's Foreign division with headquarters in Los Angeles. **A. E. Roberts,** supervising petroleum engineer for the past seven years, has been promoted to head of the Producing division.

•

TEXAS-OHIO GAS COMPANY recently added three new members to its board of directors. The new directors are: **J. P. Bristow, J. Leslie Witt,** and **Joseph W. Hibben.** In addition the company appointed **William A. Baker Jr.,** as chief geologist. The company is at present petitioning the Federal Power Commission for authorization to build a 1400 mile pipeline from McAllen, Texas, to eastern Ohio.

•

THE CARTER OIL COMPANY plans a $500,000 expansion of its research laboratory in Tulsa. Marking Carter's third major expansion of its research center in recent years, the expansion will effect a 50 percent increase of present facilities, addition of a new, separate laboratory for heavy experimental work, and construction of new storage and warehouse facilities.

•

STANDARD OIL COMPANY (INDIANA) has opened a division office for its products pipeline department at Des Moines, Iowa, to be directed by **R. H. Starrett,** formerly with headquarters at Council Bluffs. Starrett is division superintendent in charge of the products pipeline from the Sugar Creek, Mo., refinery to Council Bluffs, Sioux City, and Des Moines, Iowa, and Sioux Falls, S. D. He also supervises the line from the Neodesha, Kansas, refinery to Sugar Creek.

•

SUNRAY OIL CORPORATION and its subsidiary pipeline companies have consolidated their various pipeline systems into one operating division of the company's manufacturing, sales, and pipeline department. **J. R. (Dick) Ellis** has been named division manager of the pipelines and terminals division, and **R. E. Sleppy** has been named assistant manager.

Superintendents named are as follows: **George Martin,** Sunray Coastal Pipe Line Company at Victoria, Texas; **R. T. Plaisance,** Sunray Pipe Line Company, Bristow, Okla.; **C. V. Bishop,** chief operator, Sunray Oil Corporation's Duncan-Allen utilities pipe line at Wynnewood, Okla.; **M. E. Carroll,** chief operator at Duncan, Okla.; **R. E. Gilmore,** Allen pipeline system, Allen, Okla.; **George Vaughn,** Velma pipeline system, Velma, Okla.; and **Joe Kanive,** foreman of the Sunray Coastal Pipe Line Company segment at DeQuincy, La.

CITIES SERVICE OIL COMPANY (DELAWARE) has announced several changes in the engineering division to provide **Harris Bateman**, chief engineer, leave of absence to join the Petroleum Administration for Defense in Washington as head of the materials section. **C. S. Mitchell**, in addition to his duties as manager of crude oil supply and transportation, will be the executive in charge of the engineering division.

Ben D. (Tex) Leuty of Bartlesville, has been appointed assistant chief engineer. Leuty, named assistant manager of the crude oil supply and transportation division in charge of affiliated pipelines last year, will continue in this position.

•

REITER-FOSTER OIL CORPORATION, New York, has obtained, through litigation, certain oil and gas properties and a gasoline plant formerly operated by **FEDERAL OIL AND GAS INDUSTRIES INC.**, and the **BENNETT OIL AND REFINING COMPANY.**

The property includes eight oil and gas wells in the Joyce Richardson field, Harris County, Texas, and nine oil and gas wells and a gasoline plant having a capacity of 15 MMcf of gas per day in the Refugio-Heard field, Refugio County, Texas. The property will be managed and operated by **SAN JUAN OIL COMPANY**, Dallas.

•

NORTHERN NATURAL GAS COMPANY, Omaha, Nebr., has purchased 51 percent interest in the Permian Basin Pipeline Company at a cost of $102,000, and holds further option to purchase the entire pipeline capacity. Permian Basin Pipeline Company has on file with the Federal Power Commission an application to build a pipeline system for transporting natural gas from the Permian Basin area of West Texas and eastern New Mexico to Skellytown, Texas, where it will connect with Northern's system. Northern has a petition before FPC to increase its own capacity from 675 MMcf to 825 MMcf.

•

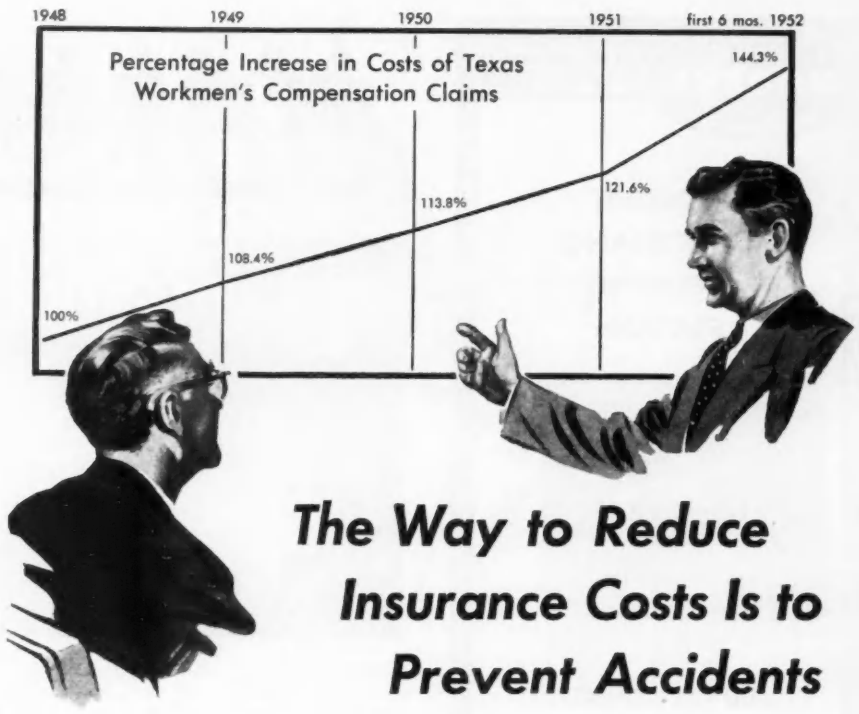
MAGNOLIA PETROLEUM COMPANY, Natural Gas Department, recently effected the following personnel changes. **Francis M. Pate** has been promoted from plant foreman of the Seeligson Gasoline Plant to an assistant superintendent of Magnolia Petroleum Company's Vanderbilt district. In that capacity he will be in charge of the Vanderbilt Gasoline Plant and other gas interests in the Vanderbilt and Luling area.

Charles A. Freeman, plant foreman at Magnolia's Sholem-Alechem Gasoline Plant near Healdton, Okla., has been transferred to plant foreman of the Seeligson Plant. **A. P. Lobrecht**, district engineer of the Healdton Natural Gas District, has been made plant foreman at Sholem-Alechem.

•

GEORATOR CORPORATION has announced formation of a Geophysical Exploration division. Engineering and exploration service in foundation, soil corrosion and prospecting work will be under supervision of **E. R. Shepard.** He formerly was in charge of geophysical foundation exploration, Army Corps of Engineers-U. S. Bureau of Public Roads.

Well-logging and special electrical investigations are under supervision of **S. Krasnow**, chief development and research engineer Geophysical Instrument Company, Division of Georator Corporation.



The Way to Reduce Insurance Costs Is to Prevent Accidents

Inflation is having a telling effect on the cost of Workmen's Compensation Insurance, as indicated by the increasing costs of claims, shown in the chart above.

There is only one way to reduce insurance costs and that is Accident Prevention. STOP needless manpower and economic waste that cost our nation over $2,650,000,000.00 in 1951. Help save lives and limbs. Firms that have safety programs say: "ACCIDENT PREVENTION PAYS."

YEAR	AVERAGE COST PER CLAIM*	CLAIM COST INDEX*
1948	106.36	100 %
1949	136.95	108.4
1950	143.76	113.8
1951	153.64	121.6
6 mo. 52	182.39	144.3

*Based on records of Texas Employers' Insurance Association using 1948 as a base year.

22 SERVICE OFFICES IN TEXAS

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CORPUS CHRISTI • DALLAS • EL PASO • FORT WORTH • FREEPORT • GALVESTON • HARLINGEN
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HOME OFFICE - DALLAS, TEXAS

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TECHNICAL CONSULTING PRODUCTION ENGINEERING SERVICE, INCLUDING CORE ANALYSIS
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On the cap!
On the auxiliary cap shoe!
On the toe!
At any intermediate point using chain as sling!

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Associations

DESK & DERRICK OFFICIALS—Officers and directors of Desk & Derrick Clubs of North America for 1953 are, left to right: Mrs. Ruth Palmer, Rocky Mountain Oil & Gas Association, Casper, Wyo., director, Region 4; Miss Doris Whiteside, Texas Mid-Continent Oil & Gas Association, Dallas, director, Region 6; Mrs. Lamont Tofte, Texas Seismograph Company, Wichita Falls, Texas, treasurer; Miss Frances Crawford, Brunini, Everette, Gantham & Quin, Vicksburg, Miss., secretary; Mrs. Irene Stimson Cox, Panhandle Producing Company, San Antonio, Texas, first vice president; Miss Margaret Neff, Dixie Geological Service, Jackson, Miss., president; Miss Anne Curren, The Ohio Oil Company, Tulsa, Okla., second vice president; Miss Eleanor Crockett, Royalite Oil Company, Ltd., Calgary, Alberta, Canada, director, Region 7; Miss Carol Eberhart, The Texas Company, New York City, director, Region 1; Mrs. Lillian Tucker, Pan American Production Company, Shreveport, La., director, Region 3; Miss Maxine R. Hacke, Warren Petroleum Company, Tulsa, Okla., director, Region 2. Missing from the lineup was Mrs. Florence M. Hopkins, United Geophysical Company, Pasadena, Calif., director of Region 5.

Desk and Derrick Group Hears Notable Oil Industry Leaders

Keynote speaker for the three day convention held by the Desk and Derrick Clubs of North America in Houston recently, was Mrs. Inez Schaffer who outlined the growth of the association since she founded the original club in 1949. The association now includes 45 clubs in this country and Canada.

Political problems were injected into the meeting when Walter S. Hallanan, president of Plymouth Oil Company and chairman of the National Petroleum Council, berated the present administration for treatment received by oilmen, and predicted that General Eisenhower would win the coming election.

A general analysis of the oilmen for whom they work was given convention members at a luncheon meeting by Russell B. Brown, general counsel for the Independent Petroleum Association of America. Other speakers included Mayor Oscar Holcombe, who welcomed the group, and Lee Wilson Hoover, New Orleans, outgoing president of the group.

Geophysical Societies Meet In Los Angeles This Month

Members of the Pacific Coast section, Society of Exploration Geophysicists, will meet at the new Statler Hotel, Los Angeles, October 30-31, for a joint meeting with the American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, and Society of Exploration Geophysicists.

Wallace L. Matjasic, Honolulu Oil Corporation, is president and chairman of SEG section; Homer J. Steiny, Tide Water Associated Oil Company, president of the AAPG; W. Thomas Rothwell, Richfield Oil Corporation, president of SEPM section; T. H. Braun, The Superior Oil Company, Southern district vice president of the SEG Pacific Section. Braun is in charge of the technical program for geophysics.

Geophysical papers will be presented in a morning session October 31, followed by a joint session of the societies. The annual dinner dance will be held October 31. Geology and paleontology papers will be presented at a morning session October 30.

Petroleum Branch AIME Holds Mid-Continent Meet in Houston

More than 1200 engineers were expected to register for the annual Mid-Continent Fall Meeting of the Petroleum Branch, American Institute of Mining and Metallurgical Engineers meeting in Houston, October 1-3. A program of 42 technical, economic and business papers were accepted for presentation in technical sessions.

M. L. Haider, president of the AIME and vice president of Standard Oil Company (New Jersey), was a principal speaker.

TIPRO Directors Schedule Meet

Directors of Texas Independent Producers and Royalty Owners Association will gather in Austin Monday, October 20, for a mid-year meeting. Bryan W. Payne, Tyler, Texas, said TIPRO will probably redefine its policy on oil imports due to the growing world oil surplus. Price decontrol of crude and other commodities not in short supply will be discussed.

Special Trains Are Scheduled For November API Convention

Special trains and schedules have been arranged by The Gulf, Colorado and Santa Fe Railway Company for delegates to the annual American Petroleum Institute Convention November 10-13 at Chicago.

From Houston the railway company has scheduled 11 pullman, two lounge and dining cars, and a baggage car. This will be a round-trip movement leaving Houston Saturday, November 8, at 7 p.m., and arriving in Chicago Sunday, November 9 at 9 p.m. This train will stop at Fort Worth and Oklahoma City to pick up delegates who wish to entrain there.

From Fort Worth the railway will operate two extra all-room pullman cars on the Texas Chief leaving at 2 p.m. Saturday, November 8.

An all-streamlined special train consisting of ten pullman cars, two lounge and dining cars, and a baggage car, will leave Tulsa Sunday, November 9 at 5 p.m. and will arrive in Chicago Monday, November 10 at 8 a.m.

The Tulsa special train will stop at Bartlesville to accommodate delegates from that territory. Reservations should be made to J. S. Rollman, City Passenger Agent of the Santa Fe in Tulsa; P. H. Swinney, Division Passenger Agent, Dallas; E. B. Melton, Division Passenger Agent, Fort Worth; and C. W. Axtell, Division Passenger Agent, Houston.

Atlantic City Scene of LPGA Convention October 27 to 31

Three events of interest to the liquefied petroleum gas industry will highlight the October 27-31 session of the Liquefied Petroleum Gas Association, Inc., at Atlantic City. On October 30 the annual northeastern district meeting of the LPGA will be held at the Ambassador hotel.

Colonel Sidney F. Mashbir, U. S. Army (retired), important to MacArthur's Pacific campaign timetable during the war, will speak on the subject, "Enemies Within."

The enlarged appliance and equipment display of the Gas Appliance Manufacturers Association will be shown in the Atlantic City auditorium, and sessions of the American Gas Association convention are scheduled for Atlantic City during the same period.

Lee A. Brand, vice president of Empire Stove Company, Belleville, Ill., and chairman of the national committee for LP-Gas promotion, will present, "You Can't Lose." Other speakers include, Howard D. White, LPGA executive vice president, Chicago; Mark Anton, president of Suburban Propane Gas Corporation, Whippany, N. J.; Walter Scott and William Arpee of C. H. Ackerman Company; Newton, Mass.; W. F. DeVoe, Phillips Petroleum Company, Bartlesville, Okla.; Gordon M. Jones, United Gas Improvements, Philadelphia; and George Webster, Pyrofax Gas Company, New York.

Southwestern District of API Schedules March 4-6 Session

The 1953 meeting of the Southwestern District of the American Petroleum Institute will be held March 4-6 at the Conrad Hilton Hotel, Fort Worth. Louis F. Davis, The Atlantic Refining Company, Box 2819, Dallas, is serving as chairman of the program committee.

It's the "follow-through" that counts

With peak work cycles becoming more crucial by the day throughout your operations, Twin Disc is all the more aware that *supplying* industry with high-performance Friction and Hydraulic Drives is only half the picture.

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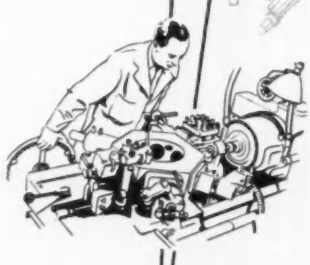
68 *To keep your equipment rolling, Twin Disc now has:*

SIXTY Parts Stations and **EIGHT** Factory Branches, fully staffed by experts ready to provide efficient service and to train your own service crews;

$3¼ million inventory of repair parts and complete replacement units; distributed at 68 Strategic locations in every industrial area—throughout the Nation.



PRODUCTION schedule on service parts closely geared to requirements from the field.

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BRANCHES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • SEATTLE • TULSA

Equipment and Service Suppliers' Notes

Chiksan and WECO Sales Executives Visit Mexican Oil Operating Areas

Following an oil field sales meeting of Chiksan and WECO personnel in Odessa, Texas, G. R. Winder, vice president and general sales manager of Chiksan Company and Chiksan Export Company, and John Gates, sales manager of Well Equipment Manufacturing Corporation, a division of Chiksan, took an extended trip to Mexico, D. F. and the Mexican oil fields.

G. R. Winder

Visits were made with officials of PEMEX, as well as drilling and service companies operating in Mexico.

According to Winder, "The Mexican oil industry is progressing rapidly, and the outlook for increased business with Mexico appears very favorable."

A RECENT DINNER meeting held at Red Deer, Alberta, by Century Geophysical Corporation of Canada was scheduled to honor 18 employes receiving three and five year service pins. Pictured above are 60 crew members, representing five of the eight Century crews operating in Canada. Immediately under the Canadian flag Opie Dimmick, president of the Canadian company as well as president of Century Geophysical Corporation, Tulsa, congratulates Winston Locker on his five years' service with the company. To the left of Dimmick is Archie Nicol, supervisor. Standing at the extreme left is James K. Ziegler, vice president in charge of Canadian operations for Century. Second from right standing is Ben Rummerfield, executive vice president of the Canadian company and vice president in charge of field operations for the Tulsa company.

Lighter . . . TOUGHER

COFFING CHALLENGER SPUR-GEAR HOIST

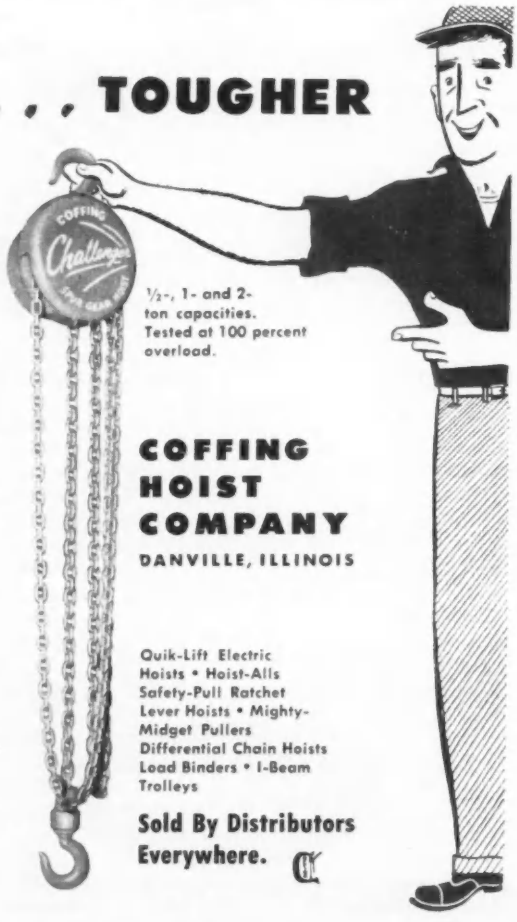
Never before such easy portability and rugged, shock-resisting strength in a spur-gear hoist . . . never such simplicity of design and ease of servicing.

Light weight—carry it in one hand: set it up anywhere. One-ton model weighs only 39½ lbs.

All Steel—even the housing. Takes shock loads and impact as only steel can.

Easy to Service—may be completely disassembled in minutes with ordinary tools. Simplest spur-gear hoist ever built.

Find out how this better spur-gear hoist can improve operations and save expense for you. Write for bulletin O10C.



½-, 1- and 2-ton capacities. Tested at 100 percent overload.

COFFING HOIST COMPANY
DANVILLE, ILLINOIS

Quik-Lift Electric Hoists • Hoist-Alls
Safety-Pull Ratchet Lever Hoists • Mighty-Midget Pullers
Differential Chain Hoists
Load Binders • I-Beam Trolleys

Sold By Distributors Everywhere.

Parkersburg Rig & Reel Appoints Lowd to New Position

Judson D. Lowd of The Parkersburg Rig and Reel Company, Parkersburg, W. Va., has been appointed assistant general manager of the company's Pressure Vessel operations.

Judson D. Lowd

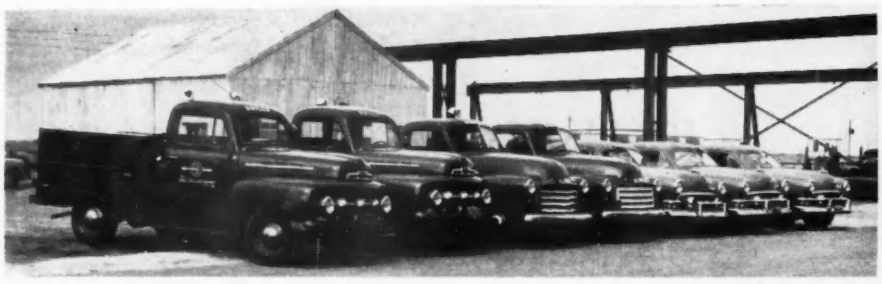
Lowd, according to W. V. Rathbone, vice president and general manager of the company, will continue to be located in Houston. Prior to his promotion, he served in Houston as manager of Pressure Vessel sales.

Colorado Fuel & Iron Corporation Resumes Work on Seamless Pipe Mill

Colorado Fuel & Iron Corporation announced that construction work has been resumed on its new seamless pipe mill being built at its Pueblo, Colo., plant. Construction of the pipe mill was suspended during the steel strike.

The company still anticipates that this mill may be completed in the first half of 1953. The mill will have an annual capacity of approximately 150,000 tons of finished pipe and tubing when rolling an average range of sizes. Seamless pipe to be produced at this new mill will supply primarily the oil and gas industry in the western and southwestern states.

The mill is centrally located to the sites of 80 percent of the known crude oil reserves of the U. S.



DRILL COLLAR SERVICE COMPANY'S enlarged fleet of field service units is shown above at the company's new service point in Odessa, Texas. Included are trucks with equipment for field inspection of drill collars and three passenger cars used for service of Drilco Torquemaster installations on drilling rigs in West Texas. Drill Collar Service Company has headquarters in Midland and service points in Snyder and Odessa.

Oil Well Supply Division Assigns Shaughness to West Texas Region

Tom B. Shaughness has been appointed assistant manager, Central Midwest area, in charge of the West Texas district for U. S. Steel's Oil Well Supply Division.

Shaughness, who has had broad experience in the manufacture and application of drilling and production equipment, has served as Gulf Coast area engineer since early 1946. He joined "Oilwell" in 1934 following his graduation from Stevens Institute of Technology with a degree in mechanical engineering.

Cummins Sales & Service Promotes Van Dyke to Head District Service

G. J. Van Dyke has been appointed district service manager at Pharr, Texas, for Cummins Sales & Service, Inc.

Van Dyke joined the company in 1945 as shop mechanic. He was promoted to field serviceman at Odessa, Texas, then to shop foreman at the same location.

OMECO Names Garth-Tex Tool New Gulf Coast Distributors

Garth-Tex Tool, Inc. of Beaumont has been appointed distributor of OMECO products in Louisiana, Mississippi, and the upper Gulf Coast of Texas.

The company will handle the complete line of Oil Metering and Processing Equipment Corporation products from offices in Houston and Beaumont, Texas, and Lafayette and Jennings, La.

National Supply Company Moves Canadian Branch Office

The district office of the Canadian division, The National Supply Company, Limited, has been moved to 208 Rawleigh Building, Edmonton, Alberta. A. Douglas Foulds is district manager and R. M. Borden is district engineer.

Houston Tool Firm Moves

A-1 Bit & Tool Company has moved its office and plant to 9000 Almeda Road, Houston, Texas.

A. L. JACOBS, left, purchasing agent for Mission Manufacturing Co., receives a certificate of award from J. T. McSpadden of Magnolia Paper Co., for the Mission E-Z Swab box, manufactured by Magnolia, which won recognition at the 1952 Setup Paper Box Competition of the National Paper Box Manufacturers Association. The Mission award was the only one given to a member of the oil industry. It stated that the box, which carries a photograph of the Mission E-Z Swab on the lid, "affords immediate brand identification and was considered an appropriate package for the product."

STEEL Kelley PRODUCTS

Do You Need a Good New Source of Metal Stampings for Defense Contracts?

Kelley has the facilities, the know-how, and the men to do your job and to do it right. From start to finish Kelley is your one source—to help you engineer stampings, to design and make the tools, and, most important, to deliver the job to your specifications on time. Kelley cut its teeth in oilfield equipment, uses that experience to make your job better.

Write for this booklet, a complete description of Kelley, shows work done, lists machines, shows how Kelley will help you.

Kelley
MANUFACTURING CO.
4800 Clinton Drive P. O. Box 17
Houston, Texas

Find out about America's finest Field Home —

The Whitmor distinctive field home is outstanding because of the variety of designs, the method of site fabrication that gives you a conventionally built house, at no extra cost. If you prefer, you can have Whitmor homes on a lease-rental plan (Write for complete descriptive illustrated brochure about Whitmor field housing).

MAIL COUPON TODAY

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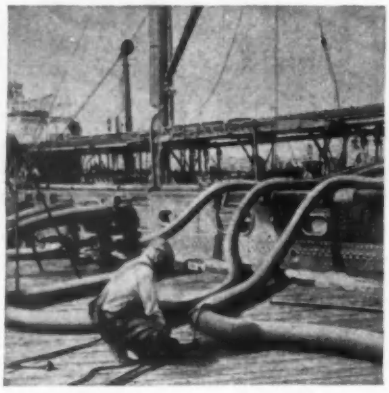
5525 East 15th St. • Tulsa, Okla.

NAME .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE .....
STATE .....

HEWITT-ROBINS



FOR FASTER TANKER TURN-AROUND

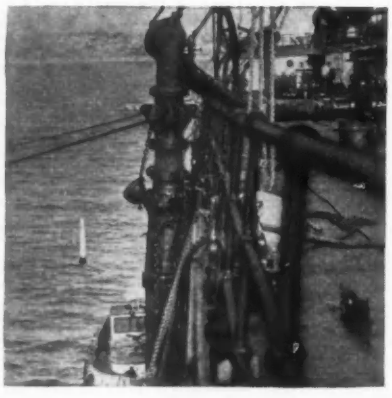
Hewitt-Robins Monarch® Oil Suction and Discharge Hose

Save up to 50% in loading and unloading time. Smooth bore, oil resistant innertube (originated by Hewitt-Robins) cuts friction resistance to a minimum . . . drains clean, as there are no wire "fuel traps" inside.

Prevents nipple leakage—Special Hewitt-Robins Durabond® process assures perfect adhesion of tube to metal . . . tube can't pull loose—it's bonded to tough duck carcass.

Right for heavy service—Strong and flexible, light in weight and easier to handle than rough bore hose.

Call your Hewitt Rubber Distributor (see "Rubber Products", classified phone book) or write for descriptive literature.



STEP UP OFF-SHORE SERVICE

Hewitt-Robins Sea Loading—Barge Loading Hose

For Sea Loading: Monarch® Sea Loading Hose has smooth bore. No coil of wire projects inside the tube . . . turbulence is cut to a minimum . . . flow increased up to 50%.

For Barge Loading: Conservo® Barge Loading Hose recommended for light barge petroleum service . . . comparatively low pressures, no severe handling. Smooth bore for fast flow. Available with either built-in steel nipples or integral rubber flange with swiveling bronze backup ring.

Get complete facts about all types of Hewitt-Robins hose. Call your Hewitt Rubber Distributor (see "Rubber Products", classified phone book) or write for descriptive literature.

HEWITT-ROBINS INCORPORATED

STAMFORD CONNECTICUT

Hewitt Rubber Division **Robins Conveyors Division**
Hewitt Restfoam® Division **Robins Engineers Division**

Kennametal Appoints Grumbaugh As Sales Development Engineer

Kennametal Inc., Latrobe, Pa., has appointed Lee Grumbaugh sales development engineer in the petroleum industry. His duties include the development and marketing of balls and seats, applied carbides for cone bits, and applications where Kennametal can be used to advantage to reduce maintenance and parts replacement cost.

Lee Grumbaugh

Grumbaugh started in the petroleum industry 25 years ago. He has since been an oil operator, specializing in well rehabilitation, at Signal Hill, Calif., has worked as development and sales engineer on drilling and pumping equipment, as consultant, and more recently he operated his own steel and pipe supply company in Colombia, South America. He will coordinate sales development activities in the home factory at Latrobe with all field points.

Montgomery Finishes PAD Duty; Named to New Halliburton Post

After a year with the Petroleum Administration for Defense in Washington, Phil Montgomery has returned to the Halliburton Oil Well Cementing Company, Duncan, Okla. Formerly manager of Halliburton's Mechanical Research and Development department before his PAD service, Montgomery has now been named technical coordinator for Cementing Services and is attached to the staff of William D. Owsley, Halliburton vice-president for engineering advice to management.

Phil Montgomery

An engineering graduate of the University of Oklahoma, Montgomery has been with Halliburton for 20 years, the first ten as a field engineer and the second ten in supervisory engineering posts at the company's Duncan headquarters.

Dowell Incorporated Advances Three Wichita District Personnel

Dowell Incorporated has promoted three men assigned to the Wichita, Kansas, district. E. H. Nielsen, a general sales engineer at Tulsa since 1949, has been named assistant district manager and will direct activities in the Rocky Mountain area from headquarters in Denver.

W. F. Brown who started with Dowell in 1936 as a student treater, has been promoted to district sales manager from district area manager. He had been assigned the latter position in April, 1952.

M. E. Hanson will maintain his title of district area manager but will increase his responsibility to oversee Dowell developments in the eastern part of the Wichita district.

SECONDARY RECOVERY AND WATER FLOOD problems exclusively will be studied in this new headquarters building of Earlougher Engineering in Tulsa. The new building contains 10,000 square feet of floor space including offices, laboratories and warehouse. R. C. Earlougher heads the organization with C. W. McIntosh, W. A. Heath and J. M. Robinson as junior partners. Earlougher Engineering is now working with 17 flood projects involving a total of more than 4000 acres from which in excess of 10,000 barrels a day is being produced. The firm has been servicing secondary recovery operations in New York, Pennsylvania, Ohio, Illinois, New Mexico, the Permian Basin and elsewhere in Texas, Wyoming and California in addition to Oklahoma and Kansas.

McCullough Tool Names Geologist As Service Engineer in Canada

Appointment of R. E. (Ernie) Haskell, Canadian geologist, as service engineer in charge of radiation well logging in Canada, was announced by I. J. McCullough, president of the McCullough Tool Company. Haskell will operate out of the McCullough divisional headquarters at Edmonton, Alberta.

R. E. Haskell

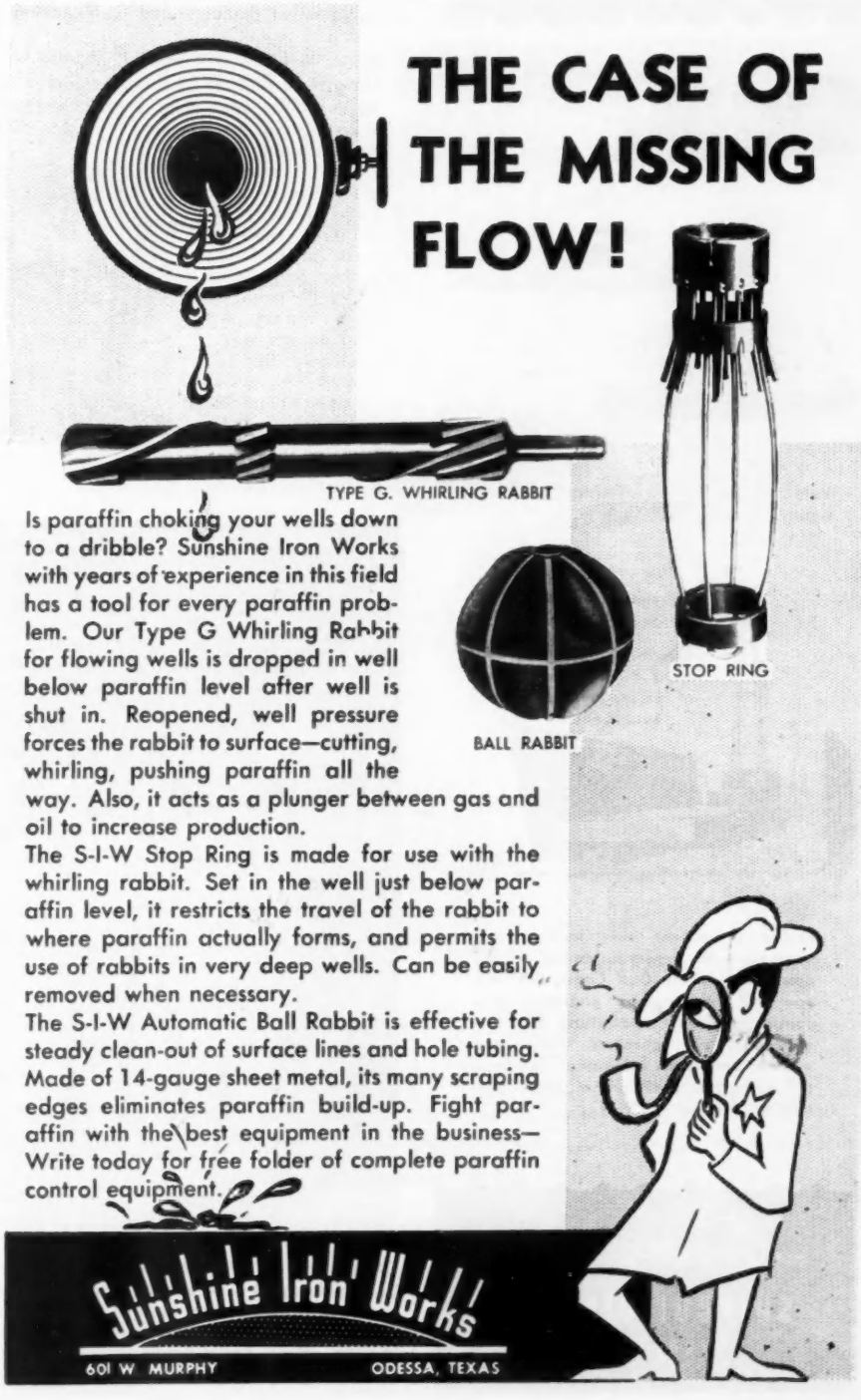
Haskell has been instrumental in the development of the new McCullough Scintillometer, the first gamma ray counter designed specifically for geological use. His role was designing and building portable and flying scintillometer instruments for use in the search for uranium in northern Canada. Later Haskell moved to Los Angeles where he worked with Dr. Robert Pringle and Philip Martin, director of electronic research at the McCullough Tool Company, in developing the Scintillometer for use in oil wells as a gamma ray counter.

Haskell holds a B.S. degree in geology from the University of Manitoba. He has arrived in Canada with a new logging truck, equipped with complete instrumentation for gamma ray and neutron logging, an Ozalid machine for making duplicate logs, necessary equipment for on-the-spot interpretation. During actual logging operations two trucks will be used. The second truck will be the standard McCullough electric wire line truck with facilities for running the logger and all other McCullough electric wire line tools into the well.

Yale & Towne Splits Lift Truck Into Electrical-Hand Departments

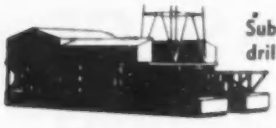
The Yale & Towne Manufacturing Company has established separate sales departments for its Worksaver and hand lift truck product lines, appointing John I. Somers as sales manager for the Worksaver department, and T. F. Moriarty as sales manager for manually-operated hand lift trucks.

Moriarty, who has authored numerous papers and articles on materials handling, was a member of the Yale & Towne staff which put the company's hand lift truck manufacturing department into operation in 1931.


THE CASE OF THE MISSING FLOW!
TYPE G. WHIRLING RABBIT
STOP RING
BALL RABBIT
Is paraffin choking your wells down to a dribble? Sunshine Iron Works with years of experience in this field has a tool for every paraffin problem. Our Type G Whirling Rabbit for flowing wells is dropped in well below paraffin level after well is shut in. Reopened, well pressure forces the rabbit to surface—cutting, whirling, pushing paraffin all the way. Also, it acts as a plunger between gas and oil to increase production.
The S-I-W Stop Ring is made for use with the whirling rabbit. Set in the well just below paraffin level, it restricts the travel of the rabbit to where paraffin actually forms, and permits the use of rabbits in very deep wells. Can be easily removed when necessary.
The S-I-W Automatic Ball Rabbit is effective for steady clean-out of surface lines and hole tubing. Made of 14-gauge sheet metal, its many scraping edges eliminates paraffin build-up. Fight paraffin with the best equipment in the business—Write today for free folder of complete paraffin control equipment.
Sunshine Iron Works
601 W. MURPHY
ODESSA, TEXAS

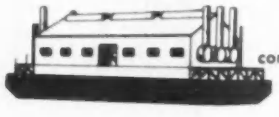
Levingston

BUILDS FINE SPECIALIZED MARINE EQUIPMENT FOR THE PETROLEUM INDUSTRY



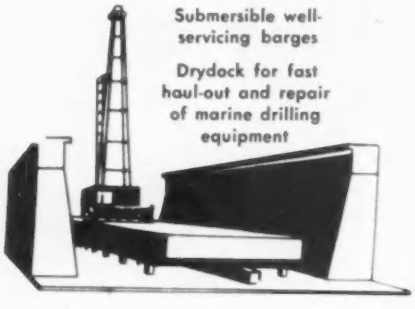
Submersible drilling barges

Tugs



Boiler and compressor barges

Water, oil, and supply barges



Submersible well-servicing barges

Drydock for fast haul-out and repair of marine drilling equipment

Levingston is not only located conveniently with respect to marine drilling operations on the Gulf Coast, but here you will find marine engineers and constructors who understand the language of oil operators. Bring your marine petroleum equipment problems to Levingston *first* for a quick economical solution.

Levingston

SHIPBUILDING CO.

Orange, Texas

JOHN A. ROEBLING'S SONS COMPANY of Trenton, N. J., manufacturers of wire and wire products, has moved into this new district office and warehouse in Los Angeles. E. C. Low, vice president of sales, said the completion of the structure marks the latest step in the company's program of expanding its sales, warehousing and product-assembly facilities. The new building is at 5340 East Harbor street in Los Angeles. Among the executive offices in the building are those of R. C. Groesbeck, district manager, wire rope division; J. L. Kelley, Pacific Coast district supervisor, wire and cold rolled products, and G. H. Cederlof, district supervisor for the electrical wire division.

Thomas E. Luke Becomes Personnel Manager of Baroid Sales Division

Thomas E. Luke has been appointed personnel manager for Baroid Sales division, National Lead Company, Houston.

Thomas E. Luke

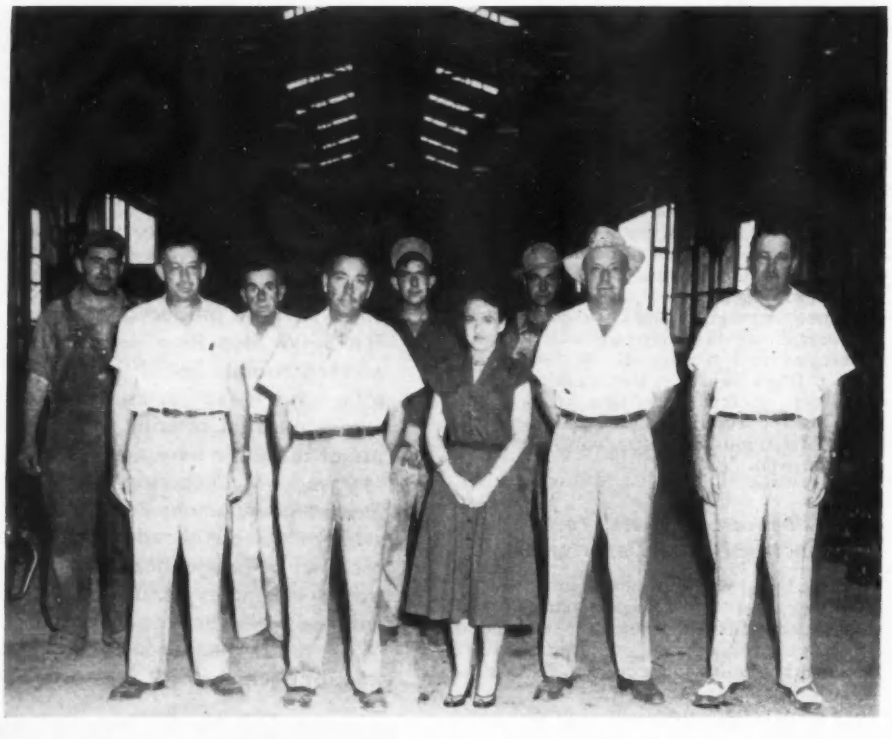
Before joining the Baroid organization, Luke was personnel director for the Rheem Manufacturing Company in Houston, following military service during the war. A graduate of the University of Texas, Luke was also connected with the industrial relations department of Shell Refining Company during 1941-42.

"Oilwell" Names D. O. Smith Gulf Coast Assistant Manager

Oil Well Supply Division of United States Steel Company recently named D. O. Smith, formerly assistant Central Midwest Area manager at Midland, Texas, and Lawrence C. Burdette, Parkersburg, W. Va., employe, in promotions.

Smith was named assistant manager of the Gulf Coast Area with headquarters in the Mellie Esperson Building, Houston. He joined "Oilwell" in 1924 as a draftsman at Oil City, and since that time has served in various capacities in Oklahoma and Texas.

Burdette, who joined the company at the Parkersburg store in 1947, was named manager.



OPERATING STAFF of the new George Rental Service Company warehouse and office located on U. S. highway 80 between Odessa and Midland greeted more than 2300 West Texans who attended barbeque festivities that marked the formal opening in August. The staff is pictured left to right: Frank Tijerina, welder; Sam W. Meek, store manager; Ruben Ensminger, warehouseman; Mrs. Vivian Walker, office; Bryon Kennedy, truck driver; J. A. Daniel, district manager; and Wood George, owner. Wood George has supplied rental rotary tools in Odessa for the past two years.

AT ITS SECOND ANNUAL SUPERVISORY conference in Dallas, Geophysical Service, Inc. brought together 40 supervisors, division managers, and management personnel representing the various areas of GSI's operations. Twenty-one papers were presented in the two day session with a round-table discussion following each paper. Dr. E. E. Rosaire was guest speaker and presented "Seismic Velocity Anomalies." Pictured are, first row, left to right, Neil Mann, Robert F. Dundon, John Imle, J. V. McManus, W. C. Edwards, Jr., Cecil H. Green, J. W. Thomas, B. F. Smith, H. B. Peacock, C. M. Moore, Jr., and W. T. Hudson. Second row: T. P. Ellsworth, K. E. Burg, M. E. Trostle, C. H. Elston, D. W. Rockwell, R. H. Rainey, P. V. Hodge, G. J. Kohler, Earl Thomas, B. A. Harris and J. W. Gary. Third row: Robert Dyk, R. D. Everett, V. W. Teufel, R. H. Wright, F. J. Agnich, T. A. Halbrook, J. L. Stephens, F. E. Romberg, R. C. Dunlap, Jr., E. J. Stulken, Clark Allen, and E. A. Kiesler.

Republic Bank in Dallas Advances Ardrey to Senior Vice Presidency

R. L. Ardrey

Rushton Leigh Ardrey, head of the Petroleum department of Republic National Bank of Dallas, has been advanced to senior vice president.

Ardrey, a graduate of Yale University, was with Guaranty Trust Company and Bank of Manhattan Company, New York, before he joined Republic in 1942.

Weco Assigns Abshire to Handle Sales in South Texas Territory

I. D. Abshire

I. D. Abshire was selected as sales representative in the South Texas area for the Well Equipment Manufacturing Corporation. His headquarters will be in Corpus Christi. He replaces C. J. (Chuck) Holcomb who was transferred to Houston for a special sales assignment.

Abshire was formerly sales representative with The National Supply Company and Mission Manufacturing Company. He has completed the WECO sales training program.

RED DEVIL

SLUSH PUMP VALVES

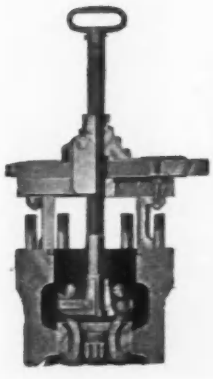
For high pressure abrasive service

In the manufacture of Red Devil Valves, particular emphasis has been given to HIGH PRESSURE ABRASIVE SERVICE at lowest possible operating costs. Their design is unique in simplicity, having only 5 parts. Valve and Seat are drop forged for maximum strength and processed for a deep high-carbon case to withstand excessive abrasive action. Seat has the least possible flow restriction and flat surface on bottom provides easy removal with Valve Seat Puller. "DIA-TEX" Inserts are Oil and Heat Resistant and can be reversed when worn on one side to double their long service life.

Write for Catalog No. P-110.

SPRING LOCK WASHER | VALVE INSERT PLATE | REVERSIBLE "DIA-TEX" VALVE INSERT | VALVE | VALVE SEAT

RED DEVIL VALVE SEAT PULLER

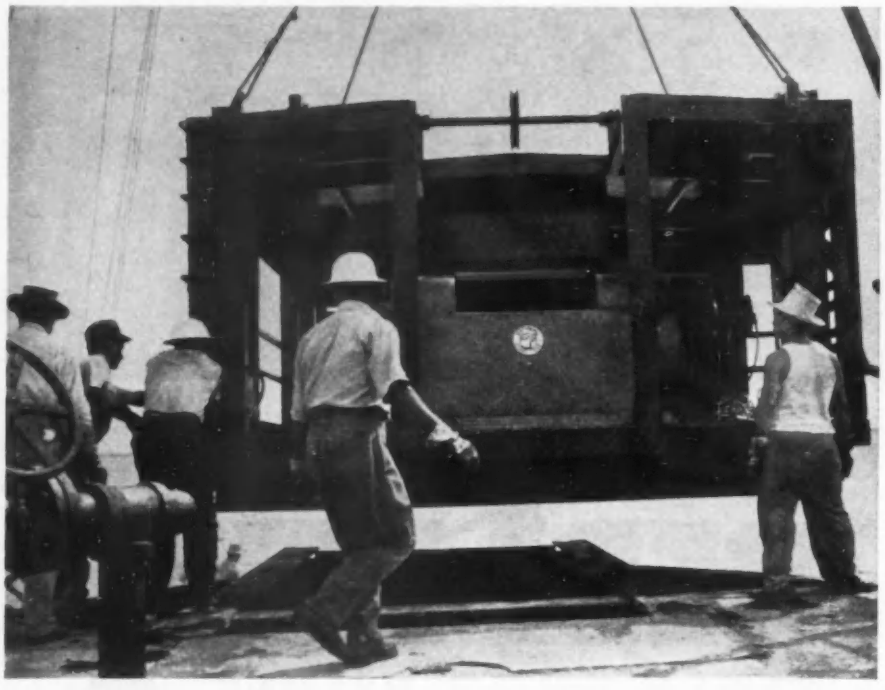


Provides a fast and positive means for pulling badly stuck valve seats by gripping the bottom rim of the seat. Eliminates the expense and hazards of removing seats with a cutting torch. All parts are made of highest grade alloy steel. Write for Catalog No. P-111

CONSULT YOUR COMPOSITE. For full information on Red Devil Valves, Pullers and other Products, see Composite Catalog or write for price catalogs noted above. Red Devil Products are available through your supply store.

OIL WELL MANUFACTURING CORP.

6008 S. Alameda St., Los Angeles 1, Calif.



Supported by the whirly crane on the sea-going tug, the ideal T-12 Rig in its special housing is guided by workmen as it nears its position across the cantilever at the Lake Maracaibo well site.

Ideal T-12 Rig Adapted for Marine Use by Venezuelan Oil Operators

An Ideal T-12 Rig, a compact and portable unit designed primarily for drilling and servicing on land, has been adapted to marine use by the Creole Petroleum Company in the Tia Juana District of Lake Maracaibo, Venezuela.

Completely housed with walkways, flooring and roofing, to suit it to this special purpose, the rig was picked up by a 20-ton whirly crane mounted on a sea-going tug, and delivered to the well site. Great care was necessary in the operation, as the water in Lake Maracaibo is quite rough and has waves as high as 10 to 15 feet.

A 24-foot base derrick, with a 14-foot cantilever extension on each side, and a floor level approximately 20 feet above the water level, is erected for original drilling of the well and is left in place over the completed well for servicing operations.

Hoisted by the crane from the deck of the tug, the T-12 Rig and its special housing was placed in position on one cantilever, and was quickly made ready for operation. The other cantilever was provided for a pumping unit, if required.

In constructing the housing, the opening for the sand line drum was boxed in, as a protection against the splash of oil from the sand line while swabbing.

T. M. Johnston Moves to Houston As Johnston Testers Executive

Johnston Testers, Inc. recently transferred T. M. "Tommie" Johnston from the West Coast office in Los Angeles to headquarters in Houston, and elevated him to executive vice president and assistant to W. B. Taylor, president. Johnston has been an executive of the company since its formation in 1951 when he transferred from the M. O. Johnston organization. A native Texan, Johnston began his oil field career as a roughneck in Smackover field, Arkansas, in 1921 while attending school. For ten years he travelled extensively in South America, Mexico, the West Indies and Canada, then in 1941 was made general manager of the West Coast and Rocky Mountain divisions of M. O. Johnston.

T. M. Johnston

Century Forms Canadian Branch; Ziegler Will Head Subsidiary

Century Geophysical Corporation, Tulsa, announced formation of Century Geophysical Corporation of Canada, a wholly-owned subsidiary. At the same time, James K. Ziegler was elected vice president in charge of the Canadian company.

Officers and directors of the new corporation are Opie Dimmick, president; Ben Rummerfield, executive vice president; Ziegler; John Carlson, secretary; Pete Bediz, assistant secretary and J. B. Bender, treasurer. Dimmick, Rummerfield, Carlson and Bender comprise the board of directors.

James K. Ziegler

Ziegler, formerly manager in charge of Canadian operations for Century, is a graduate of the Colorado School of Mines. He spent four years as a party chief for Stanolind Oil and Gas Company and was employed by several other major oil and geophysical exploration companies prior to joining Century in 1948.

Eight crews are now operating under the new subsidiary.

Greatest Name in Cable Tools

Acme

TRUSTWORTHY SINCE 1900

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION MEMBER

. . . to-be-Sure — Always Ask for Acme's Alloy Bits...

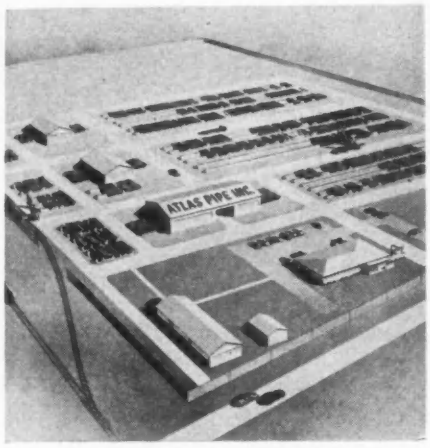
A most reasonable extra FIRST cost buys you ½-century's biggest bit buy. Delivers 50% or more actual in-hole action than any "regular" bit. Acme "Drilmor" ALLOY meets the increasing demand for a new type bit fully capable of cutting HARDEST formations; assuring more in-hole time.

Another feature (saving wasted out-time) is that Acme's Alloy Bit can be dressed and tempered in the field. And without special equipment; like "regular" bits. EXTREME, deeper penetrating hardness makes Acme's non-competitive Bits hold cutting edge, wear longer, resist battering, even in toughest going. They're longer life bits for your longer profit.

Write NOW for Alloy Bit's full facts and your copy Acme's latestCable Tool Catalog — containing proper field treatment of bits.

Fig. 108AA. Acme Alloy Bit. 51-years' specialized "know-how" makes it worth more to YOU.

ACME FISHING TOOL CO.
PARKERSBURG W. VA.
Export Office:
19 Rector St., New York 6, N.Y.



ATLAS PIPE INCORPORATED is completing the first four mill type buildings to house machinery for upsetting, threading, coupling and testing oil well tubing, casing and line pipe. The plant is being built on a 45-acre site at 7707 Wallisville Road, Houston.

Five Lane-Wells Men Receive Sales Engineer Assignments

Expanding operations in two divisions have resulted in sales engineer assignments for five Lane-Wells Company men.

Those receiving the appointments are O. T. (Tony) Bright, Leonard F. Chilton, and John S. Hatcher in the Mid-Continent division, and Tom Caton and Charles Viverette in the Gulf Coast division.

Bright began his Lane-Wells career as a rigman in 1948 and later became a radio-activity operator. His experience in the field gave him the necessary background for his new position as a district sales engineer in the Mt. Carmel, Ill., area.

Another field man who has been transferred to the sales department is Chilton who spent 4 of his 5 years with Lane-Wells as a combination operator in Cody, Wyo. He will remain in the same office, but will now function as district sales engineer.

Starting with the company in 1946, Hatcher has worked in virtually every field category and will now serve as district sales engineer with headquarters in Guymon, Okla.

Caton entered the business as a roustabout and later became a tool dresser in the West Texas fields. He joined Lane-Wells as a rigman in 1946 and has worked as a hoist man and operator. Beaumont, Texas, will be Caton's headquarters in his new assignment.

Viverette worked as a rigman on a Lane-Wells gun perforator following his graduation from Mississippi State University with a degree in geology. He later became a hoistman, perforator operator, and radioactivity well logger. In his new assignment, he will be sales engineer for the area around Odessa, Texas.

B&W Opens New Cleveland Office

The Cleveland district sales office of the Tubular Products Division of The Babcock & Wilcox Company has moved into larger facilities, on the fourteenth floor of the National City Bank Building in downtown Cleveland. The Cleveland office services northern Ohio, Erie County, Penn., and the western part of New York State. Ray E. Fleeson is in charge of the office.

BS&B Secures Bill Williams To Head Sales Training Program

Black, Sivalls & Bryson, Inc. has appointed Bill Williams director of sales training for all divisions of the company, with headquarters in Kansas City. Williams was associated with Buick Motor division of General Motors Sales Corporation as assistant zone manager at Kansas City prior to joining Black, Sivalls & Bryson. A law graduate of Southern Methodist University, Williams had previous experience as a special agent in the F. B. I. and as an officer in Military Government during the war.

Western Supply Engineer Heads NPA Engine-Turbine Division

E. D. Anderson, chief engineer for Western Supply Company's heat exchanger division, has been appointed an industry member of the Engine and Turbine Division of the National Production Authority in Washington. Rotation industry staffing of the NPA Heat Exchanger Section has been handled to date by the Tubular Exchange Manufacturers Association.

Anderson is on leave of absence from Western Supply until late December when he will return to Tulsa.

GRANT REAMER CUTTERS are angled to the right. Therefore, the Reamer will not thread itself into tight hole, and assures desirable shearing-cutting action as well as round, full-gauge hole.

Now—you get *longer wearing life than ever before* with the Grant Reamer since all parts subject to wear are component parts of the cutter assemblies. Thus, simply changing cutter assemblies renews the entire tool. *No welding is required in the manufacture or maintenance of the Reamer body, eliminating the need for shop repairs.*

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Hydrostatic Bailers	Bulletin No. 11
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Rotary Underreamers	Bulletin No. 24
Cable Tool Underreamers	Bulletin No. 27
Hole Enlargers	Bulletin No. 38
Reamers	Bulletin No. 43-A
Hydrostatic Perforation Cleaners	Bulletin No. 50
Dump Bailers	Bulletin No. 51
Roller Cutter Shale Bits	Bulletin No. 54
Sand Pumps	Bulletin No. 55
Well Cleanout Procedures	Bulletin No. 57
Wall and Bottom Hole Scrapers	Bulletin No. 58
Vertical Casing Scrapers	Bulletin No. 59

Write for Descriptive Bulletins on these Grant Tools

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Oil Field Tubular Goods Salesman Added by Lone Star Steel Company

In preparation for the completion of its oil field tubular goods mill, Lone Star Steel Company has added L. G. (Jerry) Johnson to its sales staff, in charge of sales of steel tubular goods. Johnson was formerly with Republic Steel Corporation, American Steel Warehouse Company, and Kaiser Steel Corporation.

Lone Star's new mill will probably begin producing pipe by the first of next year.

L. G. Johnson

Griffin Named Johnston Testers Perforating Division Manager

Johnston Testers, Inc., of Houston has appointed W. H. (Bill) Griffin manager of the Perforating division. Griffin was formerly division manager in the Gulf Coast territory for Welffix Jer Services, Inc., and was recently promoted to assistant to the general sales manager.

Prior to his connection with Welex, Griffin was engaged in drilling and producing activities in Canada, South America and the U. S. as a rotary driller. With Baker Oil Tools, Inc., he specialized on cementing and dual completions.

Griffin studied petroleum engineering and busines administration at the University of Houston. He is a member of the API, AIME, Technical Club, Petroleum Club, Houston Club and Nomads.

CORPUS CHRISTI, TEXAS, is the site of Oil Well Supply Division's new store. Chester L. Vines, former manager at Mission, Texas, is store manager at Corpus Christi. Others at the new store are Raymond T. Chaney and Wallace D. Newman, both field representatives.

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ELEVATORS

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TUBING ELEVATORS

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WIRE LINE DRILLING CLAMPS

- Pipe Cleaning Machines
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Get the Facts At Our Booth At the Permian Basin Oil Show October 16-19. Jean Hollis and Bill Campbell, Our West Texas Representatives, Will Be There.

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Ask Your Favorite Supply Store or Export Agent for Them

The **NEW DEAL SPECIALTY CO.** INC.

OKMULGEE, OKLA., U.S.A.

Malcolmson First DuPont Technical Representative in Southwest Area

The Rubber Chemicals division of E. I. du Pont de Nemours & Company has named R. W. Malcolmson technical representative for the Southwest, with headquarters in Houston.

Heretofore, the Company has had no resident rubber chemicals representative in the area.

Malcolmson has had ten years experience in the rubber industry. The last five have been with Du Pont, where he has been working on improved application of the company's oil resistant synthetic rubber, neoprene.

Western Company Fleet Supervisor Will Manage All Car Assignments

J. S. Caffery has been named fleet supervisor of The Western Company, Midland, and will assist J. L. Myers, assistant vice president, in development and administration of policies in regard to the company's automotive fleet. He will also supervise the assignment and maintenance of company cars.

J. S. Caffery

Caffrey has been with The Western Company since 1944 and previously was manager of the company's Odessa, Texas, field station and manager of Western's South Permian Basin district with headquarters in Odessa. He was pumping services district manager of the North Permian Basin district in Hobbs, N. M., before receiving the new assignment.

Promotions in the Pumping Services department include D. D. Walters, to manager, North Permian Basin district; Charles Simmons, to assistant manager, North Permian Basin district; Henry Landusky, to manager, Snyder station; Jim Wilson, to assistant manager, Hobbs station; J. D. Allen, to assistant manager, Seagraves station, and Roy S. Priolo, to assistant manager, Levelland station.

CELEBRATING A SILVER ANNIVERSARY

Martin-Decker Corporation, Long Beach, Calif., this year celebrates its twenty-fifth year as a business in the field of development and manufacture of oil well drilling control instruments. Floor space in the present Martin-Decker plant totals 20,000 feet, a happy comparison with the small shop in which the company originated. Since the introduction of its first piston-type wire line deflection weight indicator, Martin-Decker Corporation has made noteworthy contributions to drilling progress.

The "Silver Anniversary Model" weight indicator, Martin-Decker's latest instrument, is described fully elsewhere in this issue.

There is little comparison between this model and the so-called "Stool-Pidgeon" weight indicator manufactured 27 years ago.

Gustin-Bacon Extends Ultralite Fiber Distribution to Carolinas

Gustin-Bacon Manufacturing Company, recently announced the distributorship of the Southern States Iron Roofing Company for Ultralite glass fiber insulation has been extended to North and South Carolina.

Southern States Iron Roofing already distributes the product in Tennessee, Virginia, Alabama, Georgia and Florida, through stocking points in Nashville and Knoxville, Tenn.; Richmond, Va.; Birmingham, Ala.; Savannah, Atlanta, Albany and Augusta, Ga.; and Tampa, Orlando, Jacksonville and Miami, Fla. New stocking points will be at Columbia, S. C. and Raleigh, N. C.

E. W. Beall, Jr. will be manager of the Columbia office and Hugh Nash manager of the Raleigh office.

Gustin-Bacon Manufacturing Company also has appointed Edward A. McCabe as manager of the New York division. McCabe, a resident of Yonkers, N. Y., and an employe of Gustin-Bacon since 1942, will direct glass fiber insulation, industrial and railroad division sales in that area.

Cummins Transfers Mid-West Dealership to J. E. Everroad

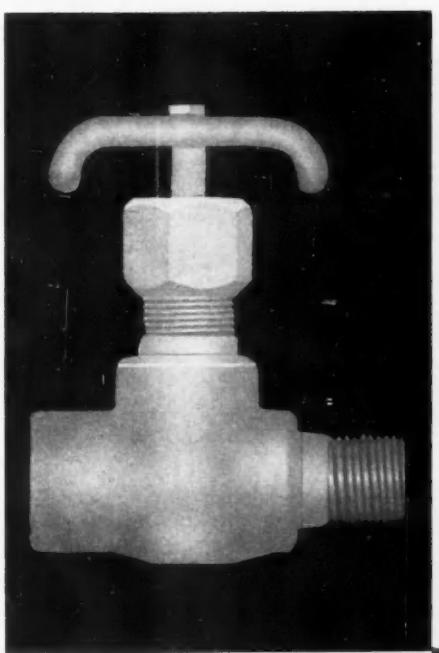
Cummins Diesel Sales Corporation has sold its facilities in Omaha to J. E. Everroad who will operate as an independently owned Cummins dealership under the new firm name of Cummins Mid-West Company. In addition, the new company will continue to operate branches in Des Moines, Iowa, and Hastings, Nebr. Everroad has been connected with the Cummins organization for 20 years.

A. O. Smith Names Five Safety Grate Stocking-Distributorships

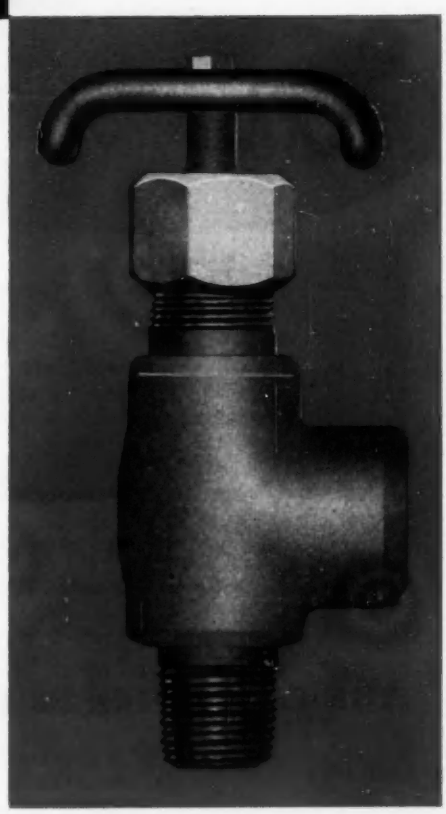
Four steel warehouses in the A. M. Castle & Company chain have been signed as stocking outlets for A. O. Smith safety grating. The Castle warehouses at San Francisco, Seattle and Los Angeles are functioning as sub-distributors for Bufnel Company, Ltd., A. O. Smith safety grating distributor on the West Coast.

The fourth A. M. Castle outlet is a stocking distributorship of Kansas City. This branch will operate through A. O. Smith's Southwest district office at Houston.

In Denver, Eaton Metal Products Company has signed as a stocking distributor for A. O. Smith safety grating.



This is the Best Connection you'll ever make!



There is a difference in needle valves . . . and O-C-T makes the difference

O-C-T Needle Valve bodies are single piece drop forged steel. The male thread is made as an integral part of the valve which gives you a more compact, stronger connection. This one-piece O-C-T Needle Valve design eliminates the use of nipples and minimizes the chances for leakage. Buy O-C-T Needle Valves from your supply store. There is a difference . . . and O-C-T makes the difference!

Oil Center Tool Co.

P. O. Box 3091

Houston, Texas

Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas.

Petroleum Engineer Will Handle Oil Loans for Fort Worth Bank

Expansion of The Fort Worth National Bank's Oil Loan division with the appointment of Lewis H. Bond, Jr., as petroleum engineer was announced. Bond, a petroleum engineering graduate of the University of Oklahoma, had been with Stanolind Oil and Gas Company since 1947. His most recent position with Stanolind was as head of the company's Fort Worth division proration section.

L. H. Bond, Jr.

Pacific Lumber Appoints Director Of Drilling Research, Development

With the appointment of William G. Van Beckum as director of research and development, The Pacific Lumber Company has announced plans for further development of redwood by-products for use in oil well drilling.

Some years ago, the firm introduced "Palco Seal," a redwood fiber lost circulation product, which is widely used in the drilling industry. Recently, The Pacific Lumber Company introduced Palcotan which is finding application as a replacement for quebracho in the conditioning of drilling muds. In previous capacities, Van Bechum has been closely associated with the development of new products for the drilling industry.

W. G. Van Beckum

Since 1948, Van Beckum has been manager of technical service and assistant sales manager, Special Products division, Weyerhaeuser Timber Company of Longview, Wash.

Larkin and Company, Inc., Appoints Al Kline Western Representative

Al K. Kline has been appointed Western representative of Larkin and Company, Inc., Butler, Penn.

Kline was formerly with Calco Oil Tools, Tulsa, and Baker Oil Tools in Oklahoma, Texas and Illinois. In his new position, Kline will be in charge of Larkin's new office and warehouse facilities in Tulsa.

Al K. Kline

Manzel Assigns Oil Representative To West Texas-New Mexico District

Manzel, manufacturer of force feed lubricators and chemical feeders, is now represented in the West Texas and New Mexico area by Ralph Nelson, of Midland, Texas.

Nelson, a Naval pilot in World War II, has for a number of years served as a sales representative in the oil industry. His appointment is the latest step in Manzel's expansion program designed to provide more personalized field service in every oil producing section of the country.

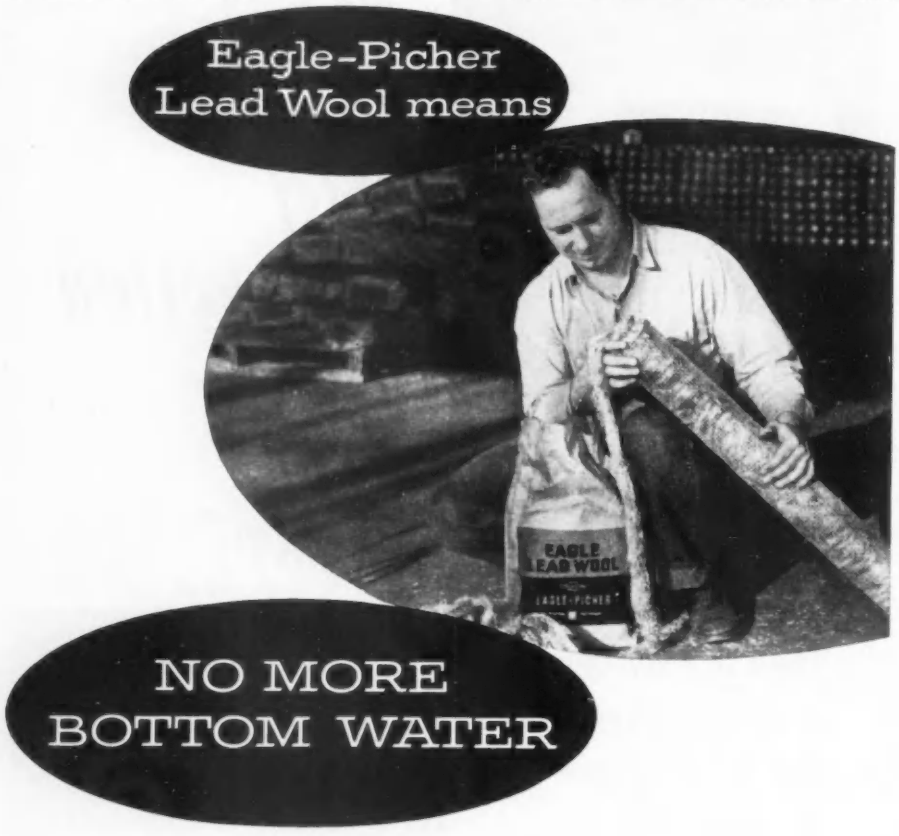
Ralph Nelson

National Supply Company Appoints Assistant Chief Design Engineer

Vernon L. Durrstein, special design engineer of The National Supply Company's Engine division for the past eight years, has been appointed assistant chief engineer of that division, with headquarters at Springfield, Ohio.

Durrstein was graduated from the University of Illinois in 1931 with a B.S. degree in mechanical engineering. Prior to joining National Supply he served as a design engineer with the Cummins Diesel Engine Company, Columbus, Ind., and as assistant chief engineer with The Buda Company, Harvey, Ill.

Vernon L. Durrstein



Keep bottom water out of your wells—and prevent costly shutdowns—by tamping Eagle-Picher Lead Wool in the hole. A watertight plug that seals every crack and crevice is made by this finely stranded, flexible metallic wool. Shipped in convenient 50-lb. sacks . . . easy to spot in special cartridge-shaped Eagle-Picher Wire Containers sized to fit all casings. Order through your jobber.

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1. **Dreadnaught**—for extreme speed and heavy-duty conditions.
2. **Outlasta**—for medium speed and average-load conditions.
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EAGLE EP PICHER

MOUNTED ON a GMC Model HCWA-625 truck equipped with oversize wheels, this National Supply Company Ideal Type T-12 drilling rig is working for Superior Oil Company on the Byrd Lease near Pine Mills in Wood County, Texas. Wells in this area are 4700 to 6000 feet deep, safely within the servicing and workover range of the 120-input-horsepower drawworks, which is also suitable for drilling in the 1500- to 3000-foot range. The double-pole mast, a product of the S & R Tool Company of Houston, is easily swung up and clamped in position. Compactness of the drawworks makes it adaptable to truck or trailer mounting. Maximum width across the two catheads is 10 feet 11 inches, but with their removal the width can be reduced to 7 feet 10 inches. Over-all length is 14 feet. In transit, the steel grating platforms are swung up beside the drawworks.

R. M. Watson

Paul Diserens

Worthington Appoints R. M. Watson To Top Position on Research Staff

Worthington Corporation has named Ralph M. Watson director of research to succeed Paul Diserens, retired.

A graduate of California Institute of Technology, Watson has been with the corporation since 1936. Since 1945 he has been assistant to the vice president in charge of engineering.

Diserens has ended 43 years of continuous service, but continues with the firm in a technical consulting capacity in engineering and research.

Hathorn to Manage Halliburton Research-Development at Duncan

A patent engineer for Halliburton Oil Well Cementing Company for 15 years, Don Hathorn was recently appointed manager of the company's Mechanical Research and Development department, which conducts basic and applied mechanical research on Halliburton services and equipment. Hathorn, a mechanical engineering graduate of Oklahoma A. & M. College, will make his headquarters at Duncan, Okla.

ACF Elects Finance Executive

American Car and Foundry Company has elected James F. Clark, formerly vice president and treasurer, as vice president in charge of finance. John F. Burditt, assistant treasurer for a number of years, has been elected treasurer of the company.

Oakite Petroleum Service Division Assigns Technician to Los Angeles

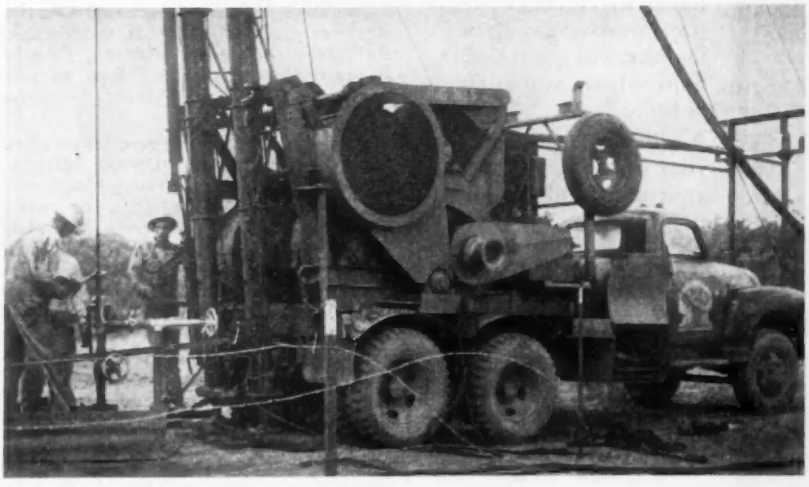
Oakite Products, Inc., has appointed Lloyd A. Blankenship to its petroleum service division at the Los Angeles offices. He will assist Pacific Coast field representatives in providing additional technical advisory service on petroleum industry cleaning and related problems. Blankenship was formerly manager and consulting engineer of Olathe Machine Company, Olathe, Kansas.

L. A. Blankenship

(Jug) Bennett Rates Wichtex Units Best

Jug Bennett, of Bennett Well Service, Graham, Texas, owns three Wichtex Servicing Units. He says: "No question about it—Wichtex machines are the best on the market."

There is a Wichtex model for every well servicing need. Pictured here is Bennett Well Service's WICHTEX Model E-75, Double-Drum Rod & Tubing Machine with spudding attachment, recommended for 10,000′ rod, tubing and bailing, and for cleanout to 6,000′. Wichtex manufactures a complete line of Rod, Tubing & Bailing Machines, Drilling In and Cleanout Machines, and Portable Rotaries. For information write WICHTEX MACHINERY CO., P. O. Box 2250, Wichita Falls, Texas.



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Now
A HYDROSTATIC BAILER
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No more lengthy, costly rentals. Cleans sand, shale, mud, plastic, cement, screens and liners. Dumps plastic, cement, pea gravel and acid.

Facts About the Sells-Simmons Bailer:

In loading hard-packed sand or large shale. This Bailer's ability to spud and repeat, make ideal loading conditions. whereas, a trip-type tool must be removed from the hole and re-set after each time it is set on bottom.

A trip-type tool will not operate in low fluids. It necessitates the loading of hole with fluid which is costly in time and material.

An efficient fishing tool for small miscellaneous junk, and recommended for use before Diamond Coring.

In low, or high fluid, this Bailer will take the hydrostatic pressures created by the physical weight of the fluid column and utilize it in unloading.

We deliver new tools to your first job, to acquaint your crew with its operation.

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WE GO ANYWHERE

L. A. Dixon

Bernard Last

Two Made Executive Vice-Presidents At Rockwell; Others Get Promotions

Rockwell Manufacturing Company elected L. A. Dixon and Jas. E. Ashman as executive vice presidents.

Dixon was with the Wisconsin Axle Company and started at the Pittsburgh Equitable Meter Company, now a division of Rockwell Manufacturing Company, in 1926 as assistant to the president. Later, he was president of the Pittsburgh-DuBois Company. When that company was acquired by Rockwell he continued to serve in the same capacity until he was appointed vice president of the company's meter and valve divisions.

Charles C. Reiff

Ashman joined Rockwell in January, 1947, as controller and later held both this position and that of vice president. He was also director of procedures for the United States Steel Corporation in Pittsburgh. As executive vice president, Ashman will be in charge of the Power Tool and Rockwell Register Divisions of the company.

Rockwell has also appointed Charles C. Reiff as chief engineer of the company's Barberton division, Barberton, Ohio, and Bernard Last to succeed him as project engineer of the Lubrication department at Pittsburgh.

Reiff received his degree in mechanical engineering from the Drexel Institute of Technology. Before joining Rockwell in 1950 as a design engineer, he held the same position at the Heintz Manufacturing Company and the Franklin Institute Laboratories for Research & Development, both in Philadelphia. In his new position Reiff will be responsible for the engineering and manufacture of Nordstrom valves.

Last received his degree in mechanical engineering from the Cooper Union Institute of Technology and also attended graduate courses at the Brooklyn Polytechnical Institute. Before joining Rockwell in 1950 he was with Mack Trucks, Breeze Corp., Inc., and the M. W. Kellogg Company. It will be Last's responsibility to develop such lubricating equipment as grease guns, bucket pumps, fittings, etc., suitable for handling all Nordstrom valve lubricants.

Hunt Names Export Representative

Travis A. Brown has been named Hunt Export Company representative in Venezuela. Brown, who was formerly with a major oil company in Venezuela, now has offices in the Avila Hotel, Caracas.

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Houston 2, Texas

W. G. Sharp

Hortenstine, Jr.

Hortenstine and Sharp Receive New Appointments at Continental Supply

Raleigh Hortenstine, Jr. has been made district manager of the Gulf Coast division, with headquarters at Houston, for Continental Supply Company.

W. G. Sharp, former sales representative at New Orleans, has been named assistant district manager of the South Louisiana district, with headquarters at New Orleans.

Hortenstine goes to his new position from that of assistant district manager of the Louisiana Gulf Coast area, having served in that capacity for the past five years.

A graduate of the University of Texas with a Bachelor of Business Administration degree, Hortenstine, in 1934, became an employe in Continental's Dallas Office. In 1941, while manager of Continental's Golden Meadows store, he entered the Army, being released late in 1945 with the rank of captain. He rejoined Continental early in 1946 as a salesman at Houma, La.

Sharp joined the Continental organization at their Houston store in 1947 as warehouseman and later as bookkeeper. In 1949 he opened the company's Harvey, La., store after serving as field salesman and manager of the Houma store. He went to New Orleans in June, 1950.

R. C. Allan

C. B. Carter

National Supply's Export Division Advances Two in New York Office

Promotion of Calvin B. Carter to assistant sales manager and of R. Carson Allan to division engineer has been announced by the Export division of The National Supply Company.

Carter started with the company following his graduation from the University of Texas in 1937. He served in the company's oil field stores in Louisiana and the Texas Gulf Coast area until 1941, when he was transferred to the Toledo, Ohio, plant. In 1944 he was appointed drilling equipment engineer for the company's Plant Products division at Houston and was made division engineer for the Export division in New York in 1947.

Allan joined the company following his graduation from the University of Michigan in 1938. During the years 1938 to 1947, he was a part of the engineering department of the Toledo plant, but most of his time was spent in the various oil fields of the Mid-Continent and Southwest. He was transferred to the Export division in 1947 and appointed assistant division engineer for export in 1948.

PGAC Sales Offices Are Opened in New Melrose Building at Houston

The downtown sales offices of Perforating Guns Atlas Corporation have been opened on the fourth floor of Houston's new Melrose Building. This brings the number of PGAC's offices in the U. S. and Canada to 16, including their general offices and main plant at Houston.

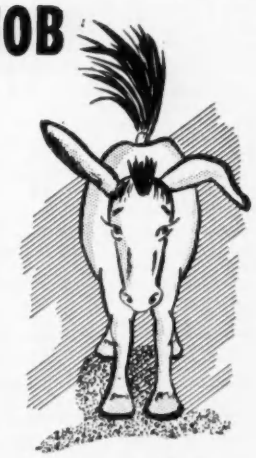
Letters—

Dear Sir:

The guest editorial for WORLD OIL, September 1952, by a business executive indicts our Army Air Force for promising recruits that they will be eligible for retirement after 20 years service. The author, a business executive, attacks the proposal as an un-American scheme of an over-paternalistic government.

I wish that the author, and your periodical, had thought through the matter before using this to blast an arm of the government that we are so dependent upon

DON'T SEND A SMALL JACK OUT TO DO A BIG JACK'S JOB



For a BIG LIFT in rig moving, or anywhere in the field, use a Texas Flange Co. Hydraulic Jack Unit. It is portable brawn that can do a day's work without looking back. Mount one in the back of your pick-up as shown, or buy the skid-mounted type that does a whale of a job with winch truck operation. Our four-jack unit is complete with portable motor, 10,000 p. s. i. pump, two hose reels, tool compartments, and four jack stands.

See Our Exhibit
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Odessa, Texas, Oct. 16-19

Two mounts can polish off a steady 18" lift on one side of a rig without a quiver in 2 to 2½ minutes. Fewer men are needed for lifting than with conventional hand-jacks. You get a powerful 200 ton push up and an even back-off with Texas Flange Hydraulic Jack Units. It's big enough for your lifting job.

SPECIAL JACKS BUILT TO YOUR SPECIFICATIONS

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■ Well drills, spudders, rotaries, core-drills. All sizes new and used equipment. Tools, drill pipe, cable, pipe. Fishing tools rented. Everything for well drilling. Pressey & Son, Pueblo, Colorado.

■ **TWO 150 horsepower F and T boilers located at Eunice, New Mexico. Makin Drilling Co., Box 131, Hobbs, New Mexico.**

■ FOR SALE: New, Western Supply Company Water Coolers, BF-3-51 horizontal Atmospheric sections, 963 sq. ft. surface, with 153-1" OD x 18 BWG x 24' Admiralty tubes, safe WP-125 psi at 300° F. Test 188 psi. Located Edmond, Oklahoma. Contact Sohio Purchasing Office, Oklahoma City, Oklahoma. Phone RE-9-0512.

■ FOR SALE: 1 Mack 1948 Model LJ 7-ton truck complete with Tulsa Model 84 winch, and Oilfield Ginpole Bed. Equipped with A1 11 x 22 rubber. F.O.B. Wichita Falls, Texas. $4500.00. Phone 2-5401 or write Jack Grace Drilling Company, Wichita Falls, Texas.

WANT RETIREMENT INCOME? For Sale, new three-bay service station on important street in Austin, leased long-term basis to Gulf Oil Corp. This is a carefree investment; safe, sound, and secure. Yields attractive income. Write David Tisinger, Attorney, Capital National Building, Austin, Texas.

FOR SALE OR LEASE

■ Longest established Pipe and Supply yard in the heart of the South Texas oil fields—consisting of ten acres of land—office building (with living quarters)—shop (two pipe machines)—warehouse—storage building. Out of the city limits on main highway. If interested write Box 1495, Alice, Texas. Phone 525, 2358 or 264J.

HELP WANTED

■ Assistant Controller—Integrated Oil Company in Mid-Continent area is seeking an experienced Assistant Controller. Position requires top-level man with experience in oil, systems and costs. Please submit resume which must give complete data on experience, salary requirement, and personal history, including education, background and associations. Box 61-W, c/o WORLD OIL, Houston, Texas.

BUSINESS OPPORTUNITIES

Unparalleled opportunity for lease owners of wildcat blocks with geology or geophysics. The Geophysical Survey Syndicate has connections with ample capital to develop wildcat properties, where our report results favorably.
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■ WE WILL BUY Producing Oil Royalties. Send Particulars. Standard Security Co., 111 Broadway, New York 6, New York.

SITUATIONS WANTED

■ FOREIGN EMPLOYMENT WANTED: Former engineer in Middle East, Europe, and South America wants permanent job overseas. 27, single, white, sober and hard working. Well acquainted with all phases of oil work, including selling and public relations. For further information write Box 59-W, WORLD OIL, Houston, Texas.

■ MECHANICAL ENGINEER—Degree, Registered Professional Engineer, age 30 years. Twelve years' experience in supervision and design of oil tools, power transmission equipment, and machine shop experience. Prefer chief engineer or assistant. Reply WORLD OIL, 60-W, Houston, Texas.

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

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in the critical years ahead. It should be obvious that:

1. The rigors of the Army Air Force can ordinarily be taken only by young men.

2. If an Air Force soldier lives through 20 years service, he is certainly ready for retirement to civilian life, and he will deserve it.

3. Since such soldier will have made an economic sacrifice he should be rewarded at the expense of us who stayed home and were shielded. Since he will have been separated from his family much of the time, and shuttled about all over the world, the retirement pay should be sufficient for him to finally become rooted.

Respectfully yours,
PAUL E. DAUGHERTY

Dear Sir:

Your article, "The Roughneck's Side," (August 1, WORLD OIL), was referred to me.

I have read it carefully and I think it is very good. The ex-roughneck, no doubt, is typical of the oil field worker and I feel sure a lot of the others are of the same opinion as this man. Of course, the average man who stays with one particular company certainly does not have to move every 30 or 40 days, as this man indicated. Neither do the average moves run as high as $100, but, of course, if inconvenience is placed on a dollar basis, it would run considerably higher. I think that you will find that many of the contractors attempt to take into consideration the men and their families in placing them on rigs where there will be continuity of work.

Excuse me for attempting to examine the statements of this man too closely as this may have been his experience, but I do not think that the average is quite as bad. Of course, we realize that a roughneck does have a side and we are, at all times, trying to find out what is on his mind and do what we can to keep our good men in our company.

I think that your idea in carrying an article of this nature is very good but I feel sure that there are a lot of them in the contracting business who might accuse you of stirring up problems. You are not able to solve them, however, until you know what these problems are.

Yours very truly,
Rowan Drilling Company, Inc.
M. L. HART, Vice-President

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New Books, Maps and Movies

PRINCIPLES OF DRILLING MUD CONTROL. Ninth Edition. Division of Extension, University of Texas, Austin, or American Association of Oilwell Drilling Contractors, Dallas. $2.50.

The ninth edition is an enlarged version of the Eighth Edition which includes four significant new chapters on mud practices in the Rocky Mountains, Williston Basin, Mid-Continent, and on the West Coast areas. These contributions have been made by area subcommittees of the API.

The importance of this manual is revealed in a recent statement "that drilling efficiency has increased 45 percent since the war, chiefly due to the educational program of the AAODC."

Since this training manual was first published 6½ years ago, almost 12,000 copies of eight previous editions have been distributed to the world-wide oil industry. About 8000 oil men have attended the "mud schools" for which this manual has been the basic text. The first printing of this edition will bring the total printing to about 17,000 copies since March, 1946.

Initiated and sponsored by the Committee on Research and Education of the American Association of Oilwell Drilling Contractors and approved by the Committee on Training of the API, Division of Production, the manual has met with an ever-increasing acceptance on the part of the drilling branch of the oil industry.

This edition marks the completion of a two year job undertaken in the Eighth Edition (August, 1951) by the API Southwestern District Study Committee on Drilling Fluids to completely rewrite the manual. The general subcommittee in charge of revising and editing the new manual was headed by J. M. Bugbee, Shell Oil Company, Houston. The committeemen offering major contributions to the manual were: George E. Cannon, Humble Oil & Refining Company, Dr. George R. Gray, Baroid Sales Division, National Lead Company, W. C. Goins, Jr., Gulf Oil Corporation, O. W. Van Dyke, Magnet Cove Barium Corporation and Preston E. Chaney, Sun Oil Company.

CROSSROADS, USA. A Columbia Studio motion picture. American Petroleum Institute, Oil Industry Information Committee, 50 West 50th Street, New York 20.

Latest in the series produced by the Oil Industry Information Committee, this film was released in time for use during Oil Progress Week this month. Made with an all-Hollywood cast, the picture tells a story of a disillusioned young man, and the split-second break which changes the course of his life. Interwoven in the fast-moving plot is a powerful close-up of the freedom and enterprise which have made this country great. The main setting is a suburban service station on a storm-swept night.

ELECTRICAL WELL LOGGING FUNDAMENTALS. Hubert Guyod, P. O. Box 2406, Houston. $3.25.

A reprinting of most of the author's papers on electrical logging, including the series of 16 articles published in 1944 in *The Oil Weekly*, and some recent papers such as "Resistivity Departure Charts," "The Shielded-Electrode Method," and "Principles of Microlog Interpretation." Some new sections cover the "Induction Method" and "Resistivity and Potential Range of Common Sediments." Another significant addition to the author's previous work is a comprehensive "Bibliography on Electrical Logging" in which the items are classified chronologically under 19 different subjects.

OIL DIRECTORY OF TEXAS. 1952 Edition. R. W. Byram & Company, Drawer M, Capitol Station, Austin, Texas. $7.50.

Names of principal officers, owners or partners of each company engaged in the oil industry are incorporated in this book. The more than 6000 operators are divided into eight groups; oil producers, gas producers, recycling plants, carbon black plants, oil purchasers, gas purchasers, refineries, plant operators.

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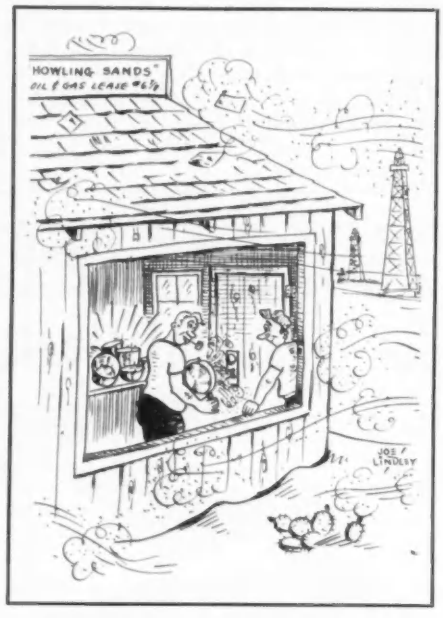

"At least it's no trouble to clean pots and pans!"

Another Tax Story

A mild little man, who had just heard the reason people were living longer was to get their taxes paid, entered his internal revenue office and was smiling at everyone. An employe stepped up and asked if there was anything he could do for him.

"Oh, dear no!" said the man. "I merely wanted to meet some of the people I'm working for."

Old Story

A pro was trying to explain the finer points of golf to a pretty beginner.

Pro: "The basic idea of golf is very simple. All you do is smack the pill, then walk."

Betty: "That's just like some dates I've been on."

She's Been Around

At a recent eclipse of the moon a college freshman arrived at the observatory with her camera. She said she was going to take a picture when the moon was entirely eclipsed. Someone remarked that she wouldn't get much of a picture, but she was unperturbed.

"Oh don't worry. I have a flashbulb attachment."

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